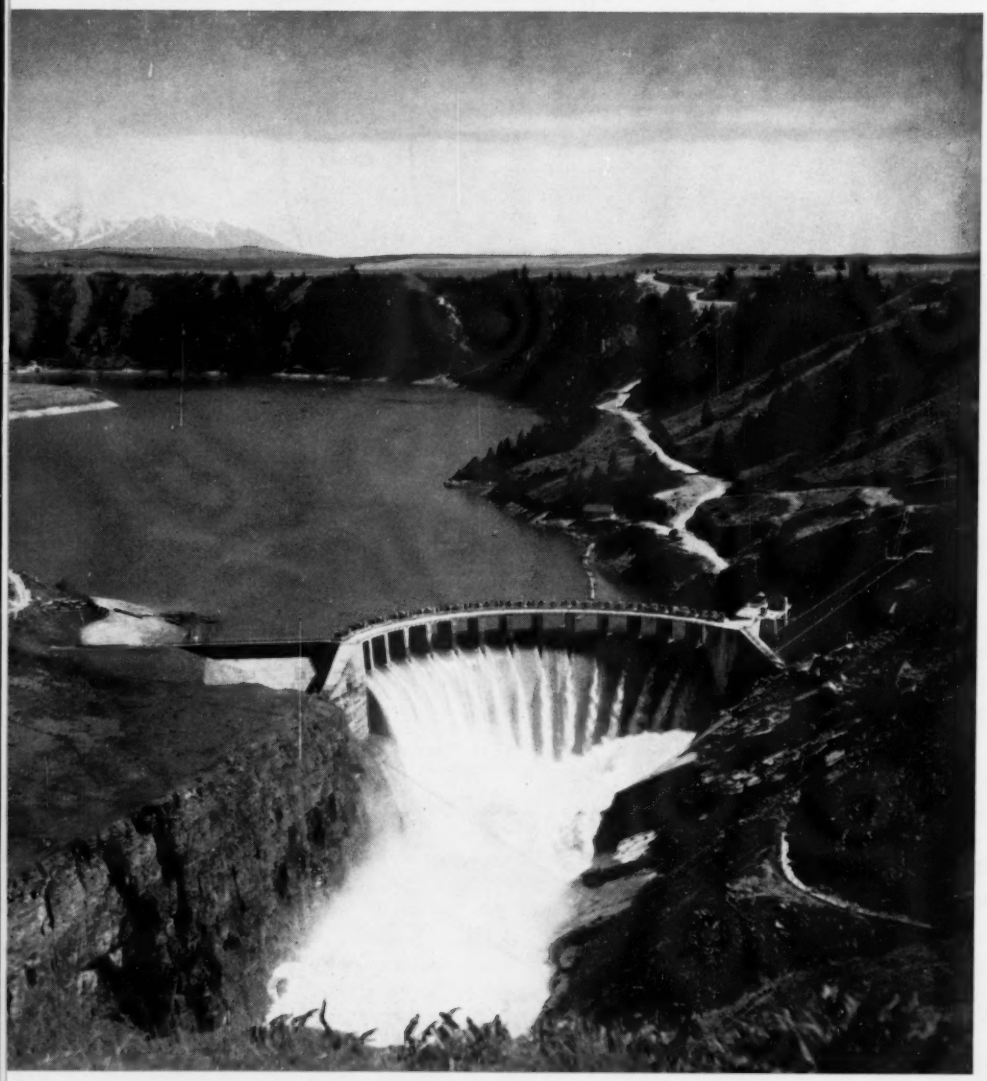
Compressed Air Magazine

AUGUST 1955



PHOTO, MONTANA POWER COMPANY

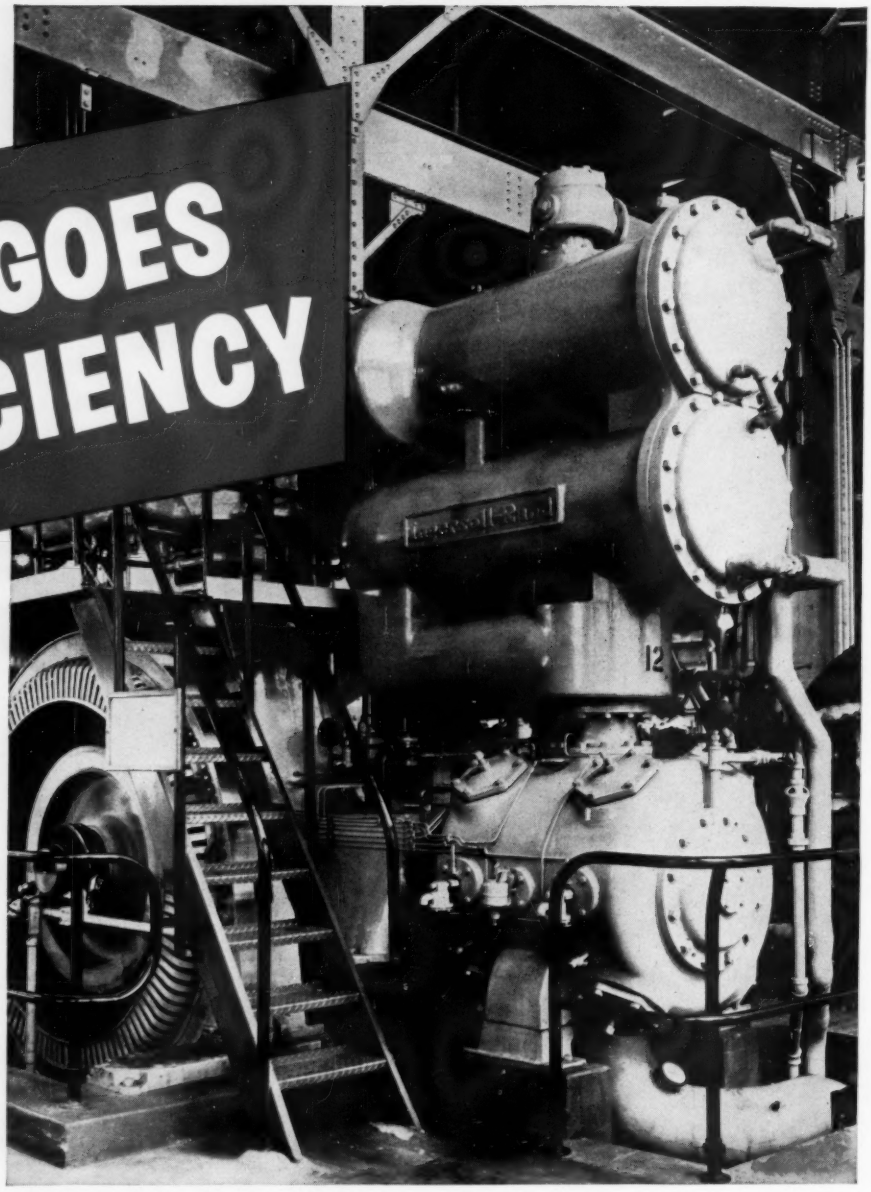
POWER DAM HAS SCENIC APPEAL

Waterfall of structure on Flathead River exceeds Niagara in height

(SEE INDEX PAGE)

VOLUME 60 • NUMBER 8 NEW YORK • LONDON

UP GOES EFFICIENCY



WHEN air compressors are lubricated with *Texaco Regal Oil R&O*, clean operation is a certainty. You'll get no rust or harmful deposits in cylinders, receivers, coolers or lines. Piston rings will stay free, valves will seat properly. Efficiency is bound to go up.

Texaco Regal Oil R&O is a premium-quality compressor oil. It is carefully refined from choice base stocks, then *further improved* by special additives and extra processing.

There is a complete line of *Texaco Regal Oils R&O*. This means you can get one perfectly suited to your compressors — whatever their size or type, the number of stages or pressure involved, or the operating conditions.

Let a Texaco Lubrication Engineer explain how *Texaco Regal Oil R&O* can step up compressor efficiency and bring down maintenance costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO REG. T.M.

TEXACO Regal Oils R&O

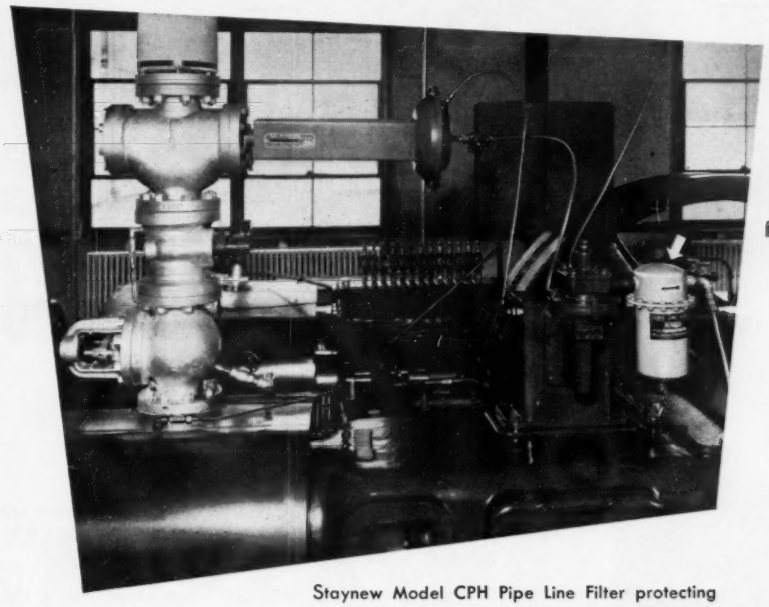
FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS

TUNE IN . . . TEXACO STAR THEATER starring JIMMY DURANTE or DONALD O'CONNOR on television . . . Saturday nights, NBC.

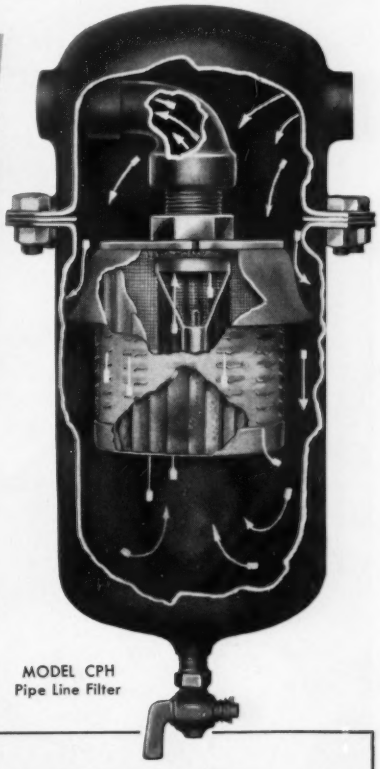
Circle 1A on reply card

STAYNEW PIPE LINE FILTERS

HELP KEEP THE PRODUCTION CYCLE ROLLING



Staynew Model CPH Pipe Line Filter protecting throttling governor on Ingersoll-Rand XPV compressor at Long Island Lighting Co., Riverhead, L. I.



MODEL CPH
Pipe Line Filter

Failure to provide proper filtration can cause delays and breakdowns due to accumulation of rust, scale, foreign particles and condensed oil in pipe lines. This disrupts the cycle of production resulting in lost time and damaged materials.

Due to sound engineering design and construction, Staynew Pipe Line Filters give dependable day in and day out performance with minimum of maintenance . . . prolong the life of your equipment and help keep the plant operating group happy.

For quick action let our Engineering Department help solve your filtration problems. Write today for Bulletin B-1A.

USED ESPECIALLY FOR

- AIR OPERATED INSTRUMENTS
- AIR OPERATED TOOLS
- PNEUMATIC CONTROLS
- INDUSTRIAL PROCESSES

Representatives in Principal Cities

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS
REG U.S. PAT OFF.

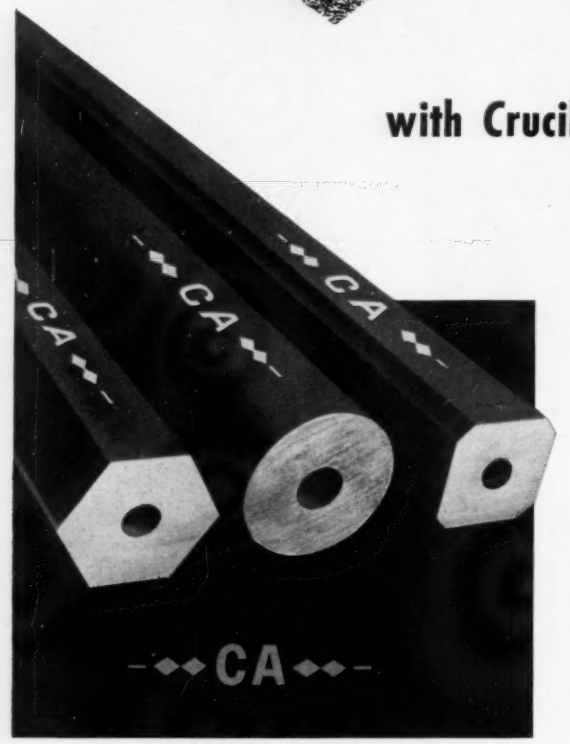
DOLLINGER CORPORATION

7 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Circle 2A on reply card

Now! 300% more hole at 60% less cost...



with Crucible CA DOUBLE DIAMOND alloy hollow drill rods

That's the phenomenal results construction men are getting with Crucible's new CA DOUBLE DIAMOND alloy hollow drill rods.

These new rods actually have *three times* the drilling life of ordinary carbon rods. On one major construction job CA DOUBLE DIAMOND alloy rods averaged *630 feet per rod*. And, although they are slightly higher in price, these longer-lasting rods cut costs by 60%.

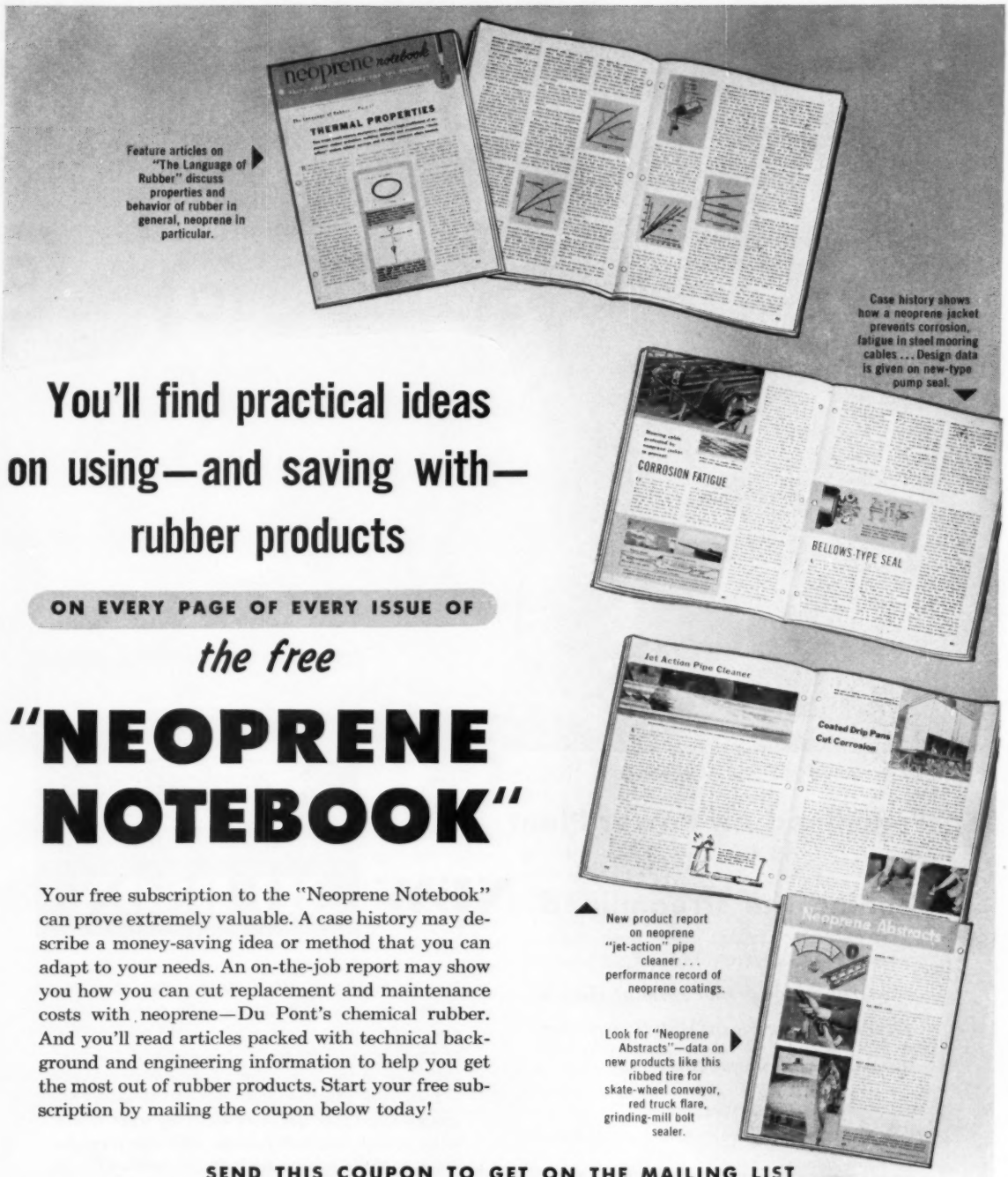
It's the *steel* that makes the difference. For CA DOUBLE DIAMOND is a tough, high-carbon, high-chromium *alloy* steel, *prescription-made* for maximum resistance to wear and abrasion. What's more, its hardness in the natural or as-rolled condition is substantially higher than carbon rods. You get a stronger rod with higher fatigue resistance.

With CA DOUBLE DIAMOND, as with any alloy steel, special heat treating methods give the best results. And they'll pay off in longer rod life . . . lower drilling costs. Crucible will be glad to supply full information on CA DOUBLE DIAMOND alloy rods . . . or on its many other alloy steels for construction applications. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Circle 3A on reply card


neoprene notebook
THERMAL PROPERTIES
Feature articles on "The Language of Rubber" discuss properties and behavior of rubber in general, neoprene in particular.
Case history shows how a neoprene jacket prevents corrosion, fatigue in steel mooring cables . . . Design data is given on new-type pump seal.
CORROSION FATIGUE
BELLOWS-TYPE SEAL
Jet Action Pipe Cleaner
Coated Drip Pans Cut Corrosion
New product report on neoprene "jet-action" pipe cleaner . . . performance record of neoprene coatings.
Look for "Neoprene Abstracts"—data on new products like this ribbed tire for skate-wheel conveyor, red truck flare, grinding-mill bolt sealer.
Neoprene Abstracts

You'll find practical ideas on using—and saving with—rubber products

ON EVERY PAGE OF EVERY ISSUE OF

the free

"NEOPRENE NOTEBOOK"

Your free subscription to the "Neoprene Notebook" can prove extremely valuable. A case history may describe a money-saving idea or method that you can adapt to your needs. An on-the-job report may show you how you can cut replacement and maintenance costs with neoprene—Du Pont's chemical rubber. And you'll read articles packed with technical background and engineering information to help you get the most out of rubber products. Start your free subscription by mailing the coupon below today!

SEND THIS COUPON TO GET ON THE MAILING LIST

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

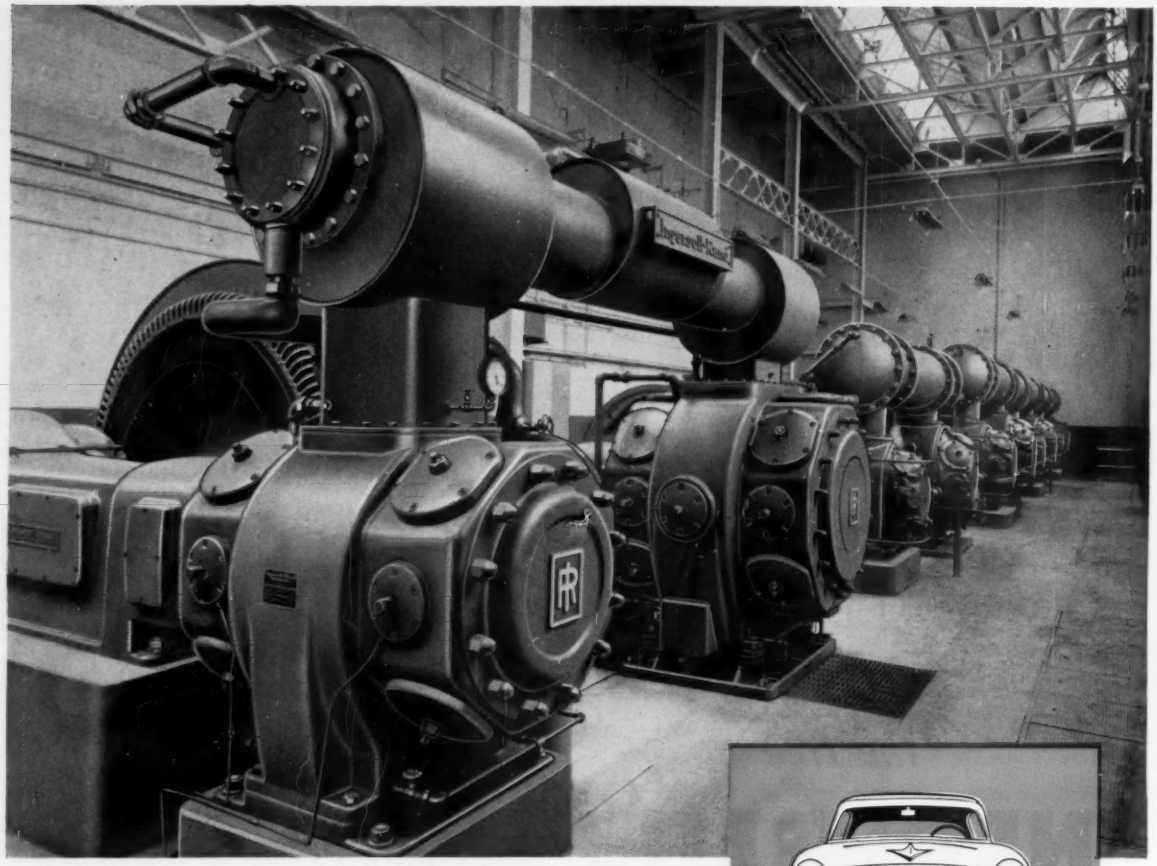
E. I. du Pont de Nemours & Co. (Inc.)
Elastomers Division, CA- Wilmington 98, Del.
Please send me the free
"Neoprene Notebook" regularly.

*Name*_____ *Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____



Streamlined Air Power Plant

behind the streamlined NEW HUDSON

Modernized compressor room at Hudson Division of American Motors simplifies operation and maintenance

AT Hudson, improvement of plant and product go hand-in-hand.

Here, the compressed air plant previously consisted of one steam- and four electric-driven compressors, in three different locations. The old steam-driven unit, which had out-lived its value as a dependable standby, was replaced by a new Ingersoll-Rand 3,000 cfm PRE compressor. All five electric-driven compressors were then installed in a single building, with receivers and aftercoolers in the basement directly below. This compact installation is shown above, with the new PRE unit in the foreground. The four other compressors are also Ingersoll-Rand PRE units. Although more than 25 years old, they were found to be in such excellent running condition throughout that there was no need for replacement.

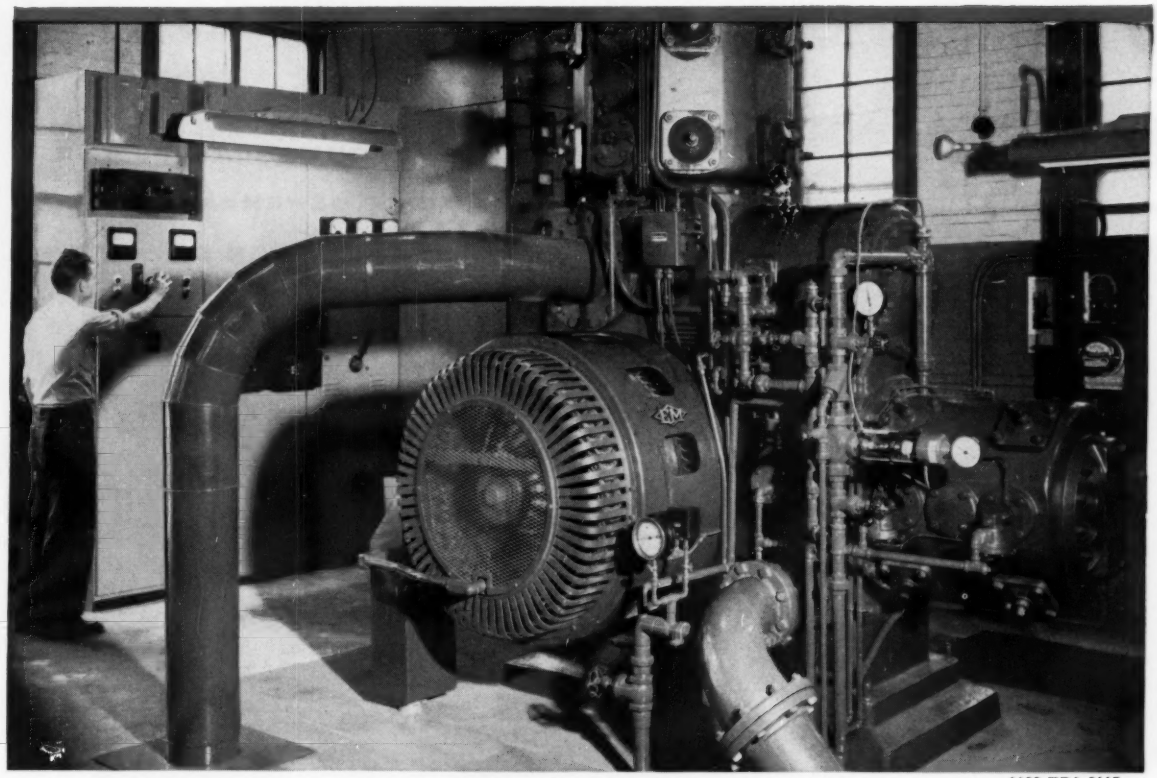
Wherever you need thoroughly dependable, low-cost air power, it pays to specify Ingersoll-Rand. Your I-R representative will be glad to show you why—and give you full details on any type of air or gas compressor. Helping you is his business!

Ingersoll-Rand

I–260 11 Broadway, New York 4, N. Y.

COMPRESSORS • CONDENSERS • AIR & ELECTRIC TOOLS • PUMPS • ROCK DRILLS • GAS & DIESEL ENGINES

Circle 5A on reply card



1100-TPA-2115

How to Make Compressors Take up Less Space

Want to save some valuable floor space?

Here's how it is done on the air compressor drive installation above:

The compressor is driven by a 200 hp, 514 rpm E-M Synchronous Motor, overhung mounted. Stator and rotor are mounted directly on compressor frame and crankshaft. Motor bearings as well as losses from belt drives and couplings are eliminated. The drive motor thus becomes a compact, integral part of the entire compressor unit.

You'll save space on any compressor with a direct-connected E-M Synchronous Motor. E-M engineers possess a unique background of experience in tailoring Synchronous Motor characteristics to drive requirements of every type of compressor. This skill, plus E-M's knack for condensing drive units into least possible space, should be considered when you plan your next compressor installation.

Also, you'll find that E-M Synchronous Motors can improve plant power factor and reduce power costs. For example, an E-M Motor rated at 0.8 leading power factor will furnish sufficient leading reactive KVA to correct a low power factor condition which may be caused by demands of other plant equipment.

Ask your nearest E-M sales engineer to demonstrate how these E-M benefits can be applied to your specific requirements. And write the factory for E-M Synchronizer No. 32, the air compressor number.

... the man at the controls

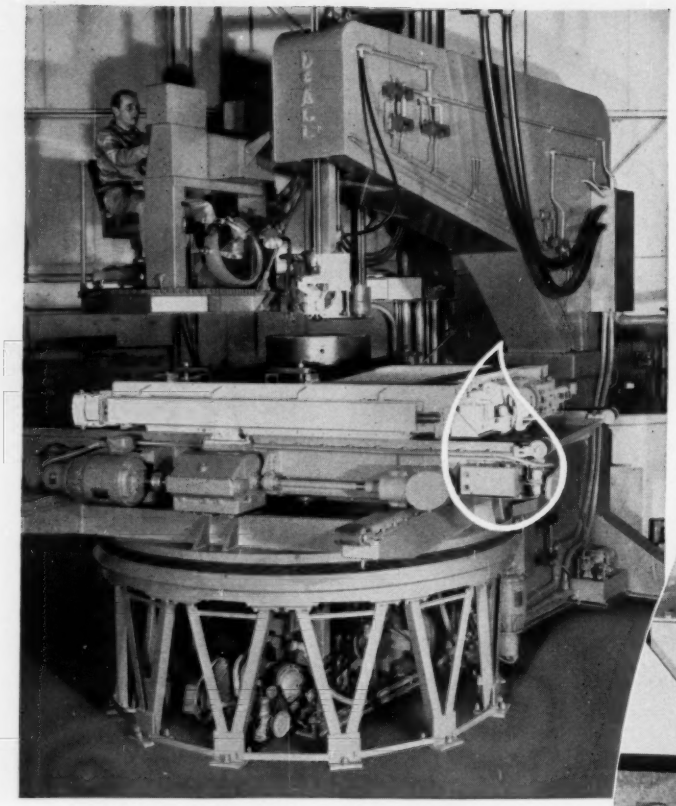
starts, stops and protects the motor with E-M special feature Controls ... magnetic, for automatic operation ... full-voltage, for economical starting ... dead-front panels for maximum safety ... overload and undervoltage protection ... and the exclusive E-M Polarized Field Frequency Relay system, simplest and most ingenious method ever developed for perfect synchronizing.

ELECTRIC MACHINERY MFG. COMPANY

MINNEAPOLIS 13, MINNESOTA

E-M

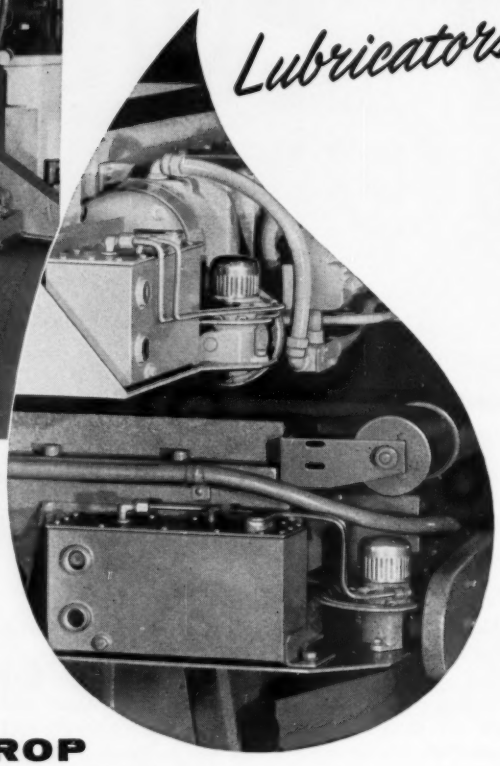
POWER THAT THINKS... E-M SYNCHRONOUS MOTORS AND "CONSCIOUS" CONTROLS



MACHINES OF GREAT PERFORMANCE USE THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED

...MADISON-KIPP

Lubricators



Two Madison-Kipp OL Lubricators installed on the world's largest band machine and die filer, manufactured by the DoALL Co., Des Plaines, Illinois...Operated by remote control, they machine 10-ton extrusion dies for the Air Force "Heavy Press Program."

Fresh Oil...

BY THE MEASURED DROP

...from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

kipp

MADISON-KIPP CORPORATION
202 WAUBESA STREET • MADISON 10, WIS., U.S.A.

● Skilled in Die Casting Mechanics ● Experienced in Lubrication Engineering ● Originators of Really High Speed Air Tools

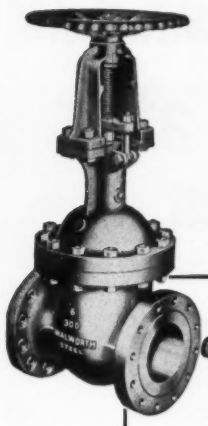
Circle 7A on reply card

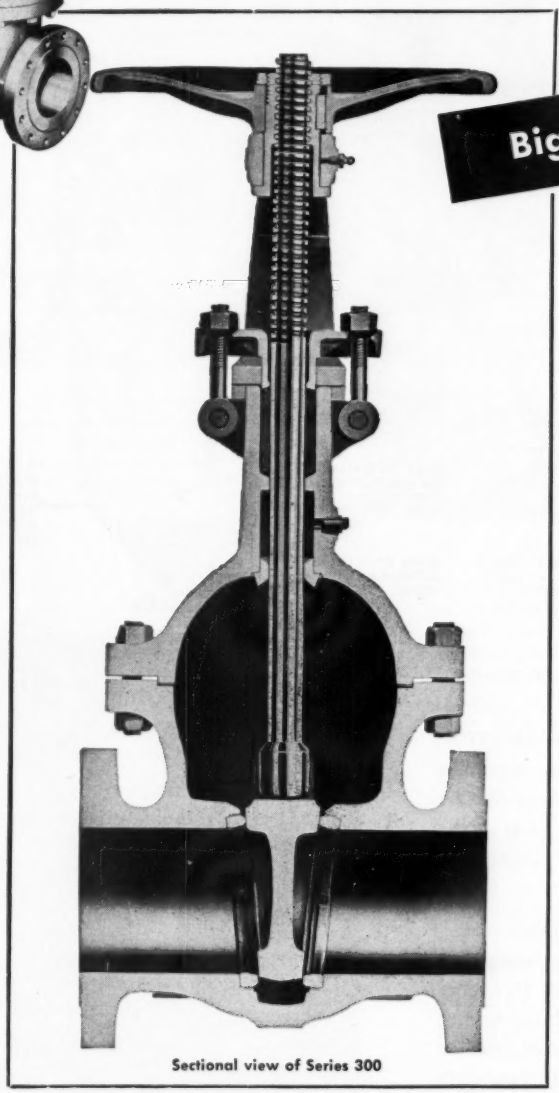
WALWORTH

Cast Steel Gate Valves

Series 150 and 300

Wedge Gate — Outside Screw and Yoke





Sectional view of Series 300

Big 8-Point Superiority!

Gland clearances are such that stem cannot be scored if gland should be tightened unevenly.

Deep Stuffing Boxes in all sizes (2″ to 24″) insure tightness and maximum packing life – costly leaks are eliminated.

Bonnets and Bodies are engineered to withstand pressure and minimize distortion – they're tough, durable, dependable.

Heavy Steel Walls provide extra strength and longer life.

Integral Body Guide Rib Faces are machined to insure accurate disc seating.

Seat Rings are bottom seated – not flange type. No recess exists at back of ring – hence no turbulence, erosion, or pressure drop.

Streamlined Ports allow high velocity, non-turbulent flow, and reduce the possibility of erosion.

Valves regularly have flanged ends. They can be supplied with ends for butt welding. Roller bearing yokes are available. On valves 5 inches and larger, by-passes can be furnished.

For Series 600 and higher, we recommend Walworth Pressure-Seal Steel Gate Valves.

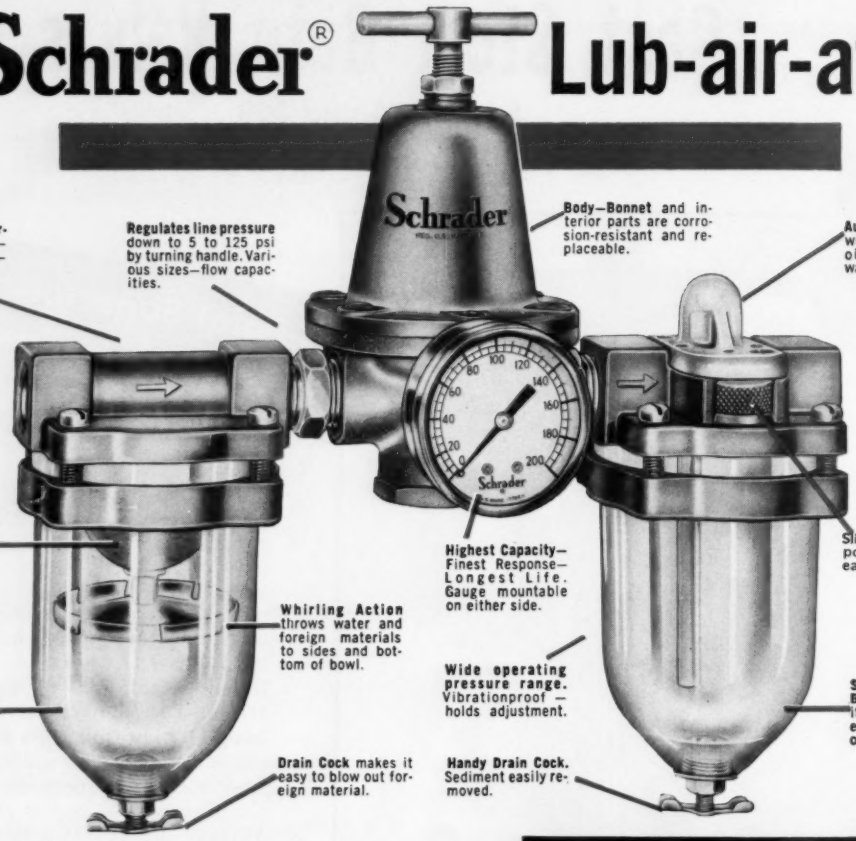
For further information on Walworth Cast Steel Gate Valves, see your local Walworth distributor, or write:

WALWORTH

NEW!

FILTER...REGULATE...LUBRICATE with this

Schrader® Lub-air-ator


Schrader
Finest sintered filtering — automatic — completely rustproof—various sizes.
Regulates line pressure down to 5 to 125 psi by turning handle. Various sizes—flow capacities.
Body—Bonnet and interior parts are corrosion-resistant and replaceable.
Automatic Lubrication with sight feed. Adjust oil flow while you watch.
Sintered Bronze Filter Minimum pressure drop. Removable filter easily cleaned without disturbing piping.
Whirling Action throws water and foreign materials to sides and bottom of bowl.
Highest Capacity—Finest Response—Longest Life. Gauge mountable on either side.
Sliding-Seal covered port permits quick, easy refill.
Wide operating pressure range. Vibrationproof — holds adjustment.
Sturdy Transparent Bowl permits constant visual policing.
Sturdy Transparent Bowl—½ pint capacity. Oil level always evident. Refill without shutting off air.
Drain Cock makes it easy to blow out foreign material.
Handy Drain Cock. Sediment easily removed.

Easily maintained. No moving parts—can be serviced without disturbing pipe connections.

Now! An all-in-one installation! The Schrader LUB-AIR-ATOR. This new, quality unit is designed to do these three important jobs: *filter* clean the air as it moves through system—*regulate* air to proper pressure requirements—*lubricate* moving parts in the correct amount to minimize wear and friction. End result: your valuable air tools give longer trouble-free service.

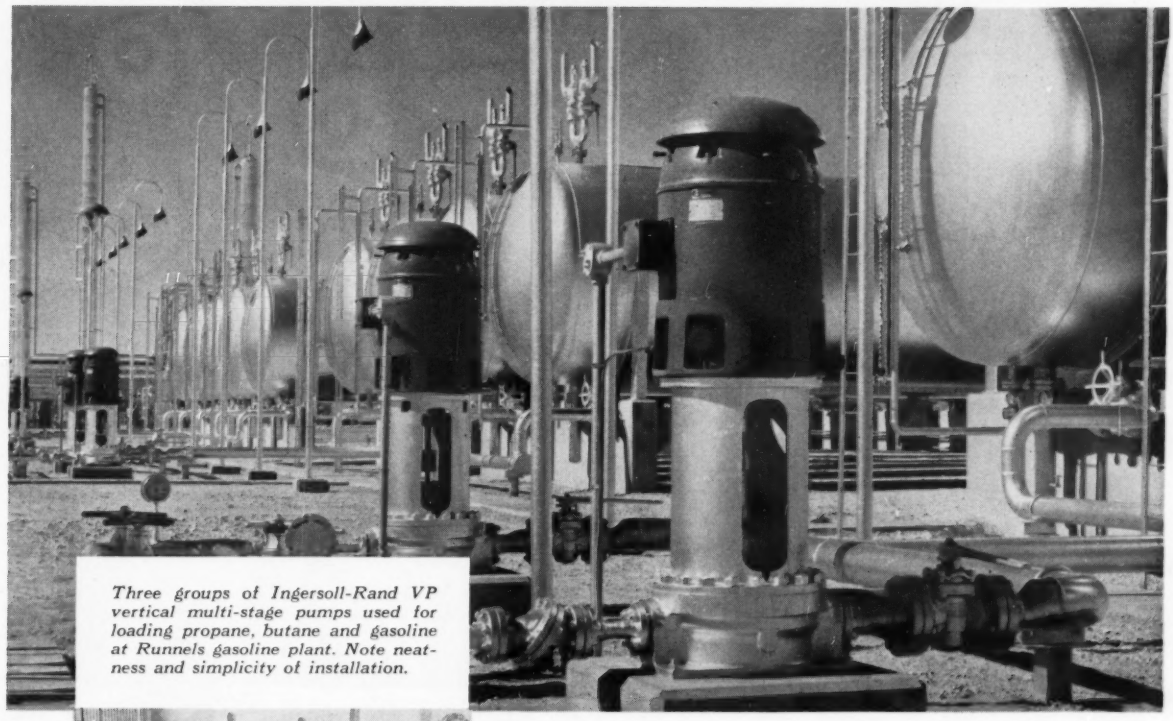
Use a Schrader LUB-AIR-ATOR wherever you need dependable, safe air service. And . . . if you design products with air equipment and controls—"build in" the Schrader LUB-AIR-ATOR. Its quality complements *your* equipment. For a fully illustrated specification sheet write us! Act now! Address A. SCHRADER'S SON, Division of Scovill Manufacturing Company, Incorporated, 478 Vanderbilt Avenue, Brooklyn, New York.

Schrader
REG. U. S. PAT. OFF.

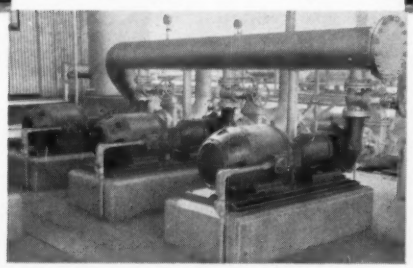
LEADERS IN AIR CONTROL SINCE 1844

I-R Vertical Pumps Serve All Loading Facilities at

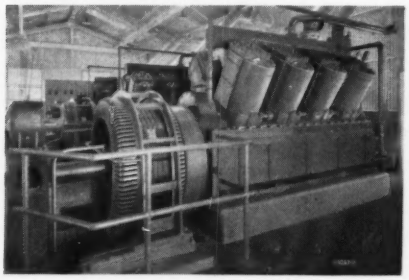
Runnels Gas Products Corporation



Three groups of Ingersoll-Rand VP vertical multi-stage pumps used for loading propane, butane and gasoline at Runnels gasoline plant. Note neatness and simplicity of installation.



Three Ingersoll-Rand CRVL pumps handling jacket water at 2200 gpm and 75 ft. head. Two other CRVL units handle water for the lube oil coolers.



Three Ingersoll-Rand PSVG gas engines, driving 380 kw generators at 514 rpm, provide electricity for the entire plant.

This ultra-modern plant at Winters, Texas, processes about twenty million cubic feet of natural gas per day by condensate fractionation. And *all* product loading facilities are served by Ingersoll-Rand Class VP vertical multi-stage pumps.

Four and five-stage units handle propane, butane and gasoline at 100 gpm and total heads ranging from 973 ft. to 1240 ft. As shown in the photograph above, these VP pumps require very little installation space and permit simple piping arrangements. No bedplates or elaborate foundations are necessary. Other I-R equipment at this plant includes three PSVG gas engines, one Type 30 and two Type 40 air compressors, and five CRVL pumps.

Liquid-moving requirements in the process industries vary widely — in pressure, capacity, temperature, physical or chemical properties. Yet there's a standard I-R centrifugal pump that will meet virtually *every combination* of these variable factors. Your Ingersoll-Rand representative will be glad to assist you in making the right selection.

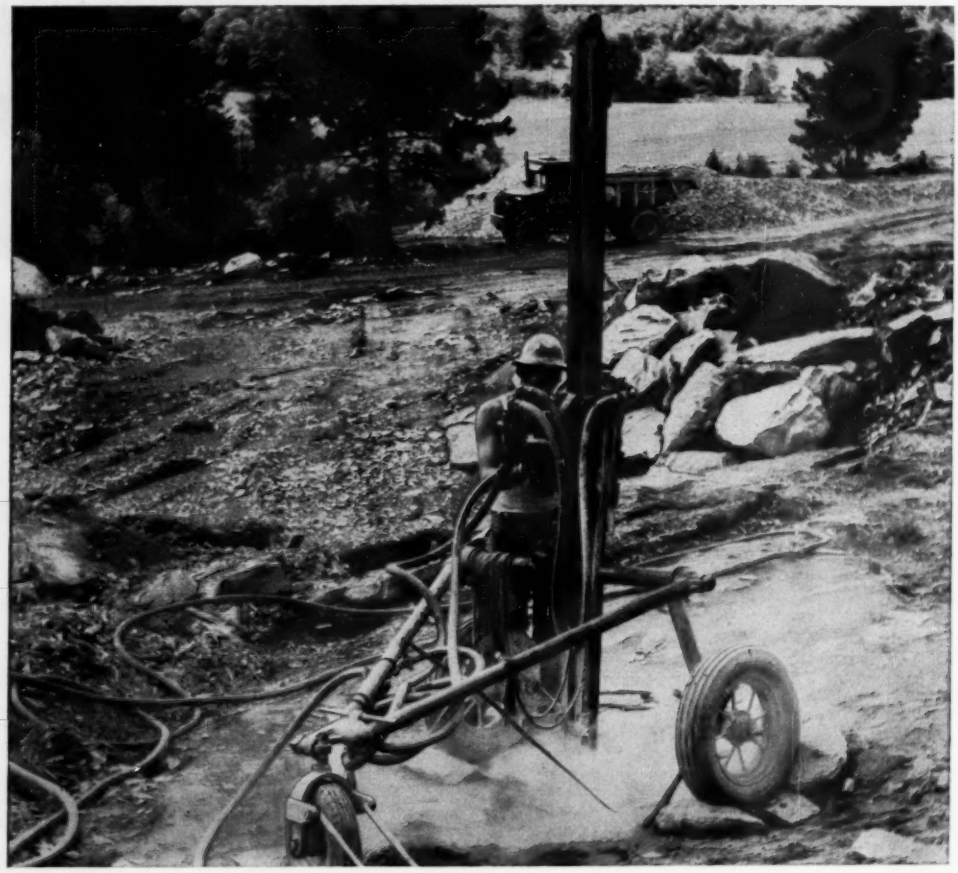
Ingersoll-Rand

Cameron Pump Division
11 Broadway, New York 4, N. Y.

10-127

PUMPS • CONDENSERS • TURBO-BLOWERS • COMPRESSORS
ROCK DRILLS • AIR & ELECTRIC TOOLS

Circle 10A on reply card



The Wagonjack cuts drilling time in half for scores of jobs. How? Powered forward drill feed, positive feeding pressures, maneuverability, and use of long drill steel. It's a good way to save money. And also to eliminate much of the heavy, tiring work previously performed by manpower.

More than 50 parts strengthened by Nickel Alloy Steels

In Ingersoll-Rand Wagonjack Drill Rigs

THIS EQUIPMENT drills up to 31" per minute through solid granite, depending on air pressure and bit size. It drills at extreme speeds with surprisingly little gage wear. And with a minimum of bit changes.

Look into this WAGONJACK! A real *one-man mounting*, it speeds up work on any job.

You'll find that nickel alloy steels add stamina to more than 50 vital parts of this rig. Ratchet, rifle bar, driver and chuck are made especially durable by using nickel steels.

And think of the terrific beatings taken by rock drill frontheads and chuck bearings. These parts stand the gaff, because Ingersoll-Rand makes them from tough nickel steels that resist breakage.

Heart of the rock drill . . . valve chest and guide . . . is of nickel steel, too. Because in reversing some 4000 times per minute, the valve calls for seating faces that *stay true*. Otherwise efficiency falls.

Under the most severe working conditions, you'll find that the desirable combination of strength, toughness and hardness of steels containing nickel can assure dependability of all such vital parts.

When you have a metal problem, make use of our wide practical experience. Let us show you how a nickel alloy may be the exact answer you are looking for. Send details of your difficulty for our suggestions. Take the first step now . . .

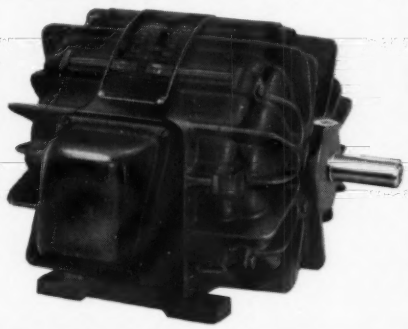
Write for List A of available publications. It includes a simple form that makes it easy for you to outline your problem.

INCO TRADE MARK

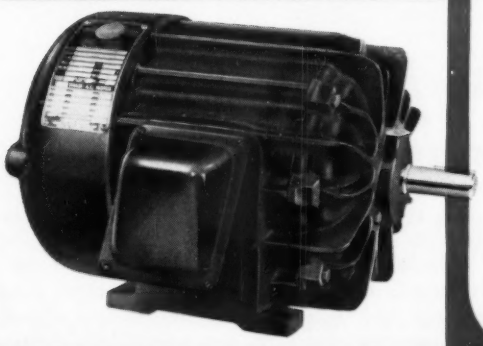
THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N. Y.

DUST-PROOF!
MOISTURE-PROOF!

TWO NEW "DIEHL MOTORS FOR Air-Over-Motor" APPLICATIONS



Type "DIE" Motor (Not Fan-Cooled)



Type "DIF" Motor (Fan-Cooled)

Tops in Quality — Competitive in price!

When you buy or specify motors for fans, blowers, unit heaters, air conditioners, cooling towers or dehumidifying systems *don't overlook* these two new standard or custom-designed Diehl Totally-Enclosed Motors.

Smaller in size, lighter in weight, precision-engineered and precision-built to new NEMA standards, they are ideally suited to "air-over-motor" applications where moisture, fumes, dust and other airborne particles are a problem ... a field in which Diehl has long been a leader.

Diehl

Visit us at Booth No. 429 at the
THE PRODUCTION ENGINEERING SHOW
(the Automation Exposition)
Navy Pier, Chicago
September 6-10, 1955

DIEHL MANUFACTURING COMPANY
Electrical Division of THE SINGER MANUFACTURING COMPANY
Finderne Plant, SOMERVILLE, N. J.

Please send me the following bulletins:
☐ New Type "D" Motor Bulletin No. CA-3304
☐ Consolidated Catalog & Price List No. CA-3310

Name_____
Company_____
Street_____
City_____ State_____

INTEGRAL AND FRACTIONAL HORSEPOWER MOTORS ARE AVAILABLE IN A WIDE RANGE OF TYPES AND SIZES

Circle 11A on reply card

Wagon drills, equipped with Bethlehem Hollow, chew blast holes on Sand Mountain, between Attalla and Boaz, Ala.

150,000 cu yd of Mountain Rock Moved for Alabama Highway

As part of its improvement program, the Alabama State Highway Department recently called for the relocation of 6.84 miles of the Attalla-Boaz highway, near Gadsden. Upon completion late in 1955, the new route, through virgin country on Sand Mountain, will offer motorists a commanding view of the picturesque countryside.

To clear the way for the new road it was necessary to move 150,000 cu yd of medium-hard limestone. The contractors and engineers, McDowell & McDowell, Nashville, Tenn., accomplished this economically by means of jackhammers and wagon drills, equipped with 1-in.-hexagon Bethlehem Hollow Drill Steel, fitted with carbide-insert bits. The drill steel was fabricated and supplied by Cowin Equipment Co., Inc., Birmingham.

Whatever the rock-removal problem, you can be sure of steady, low-cost drilling with Bethlehem Hollow. This is because Bethlehem Hollow is rolled from a tough, fatigue-resisting steel. Its wide quenching range makes it easy to heat-treat for the ideal balance of hardness and wear-resistance. It also makes long-wearing threads and tough shanks.

Bethlehem Hollow comes in rounds, hexagons and quarter-octagons, generally in lengths of 18 to 25 ft, though longer when specified. You'll like it.

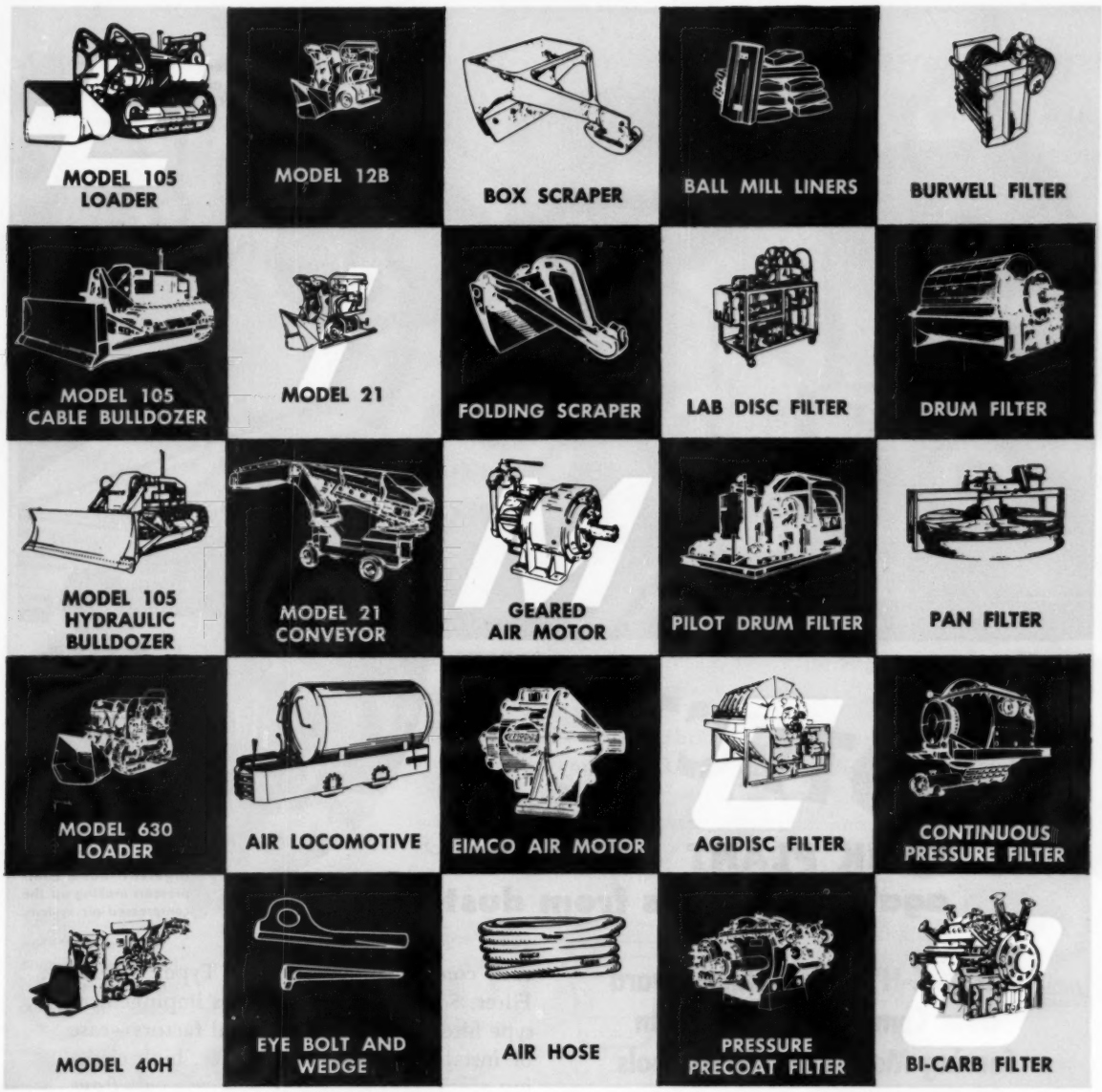
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM HOLLOW DRILL STEEL

Circle 12A on reply card



SAVE—WITH EIMCO PRODUCTS

Eimco products are built to last. They are the result of more than half a century of experience in serving the mining, contracting and processing industries.

Every product bearing the familiar Eimco name is your assurance that the product is the best of its kind available anywhere.

Constant research is maintained in order to keep Eimco products out in front. This fact can be verified by the number of "firsts" that Eimco has contributed to these various industries. In design, efficiency and ease of handling, Eimco products will contribute greatly to your operation.

The experience of thousands of users throughout the world bears testimony to the truth of the statement, "You can't beat an Eimco."

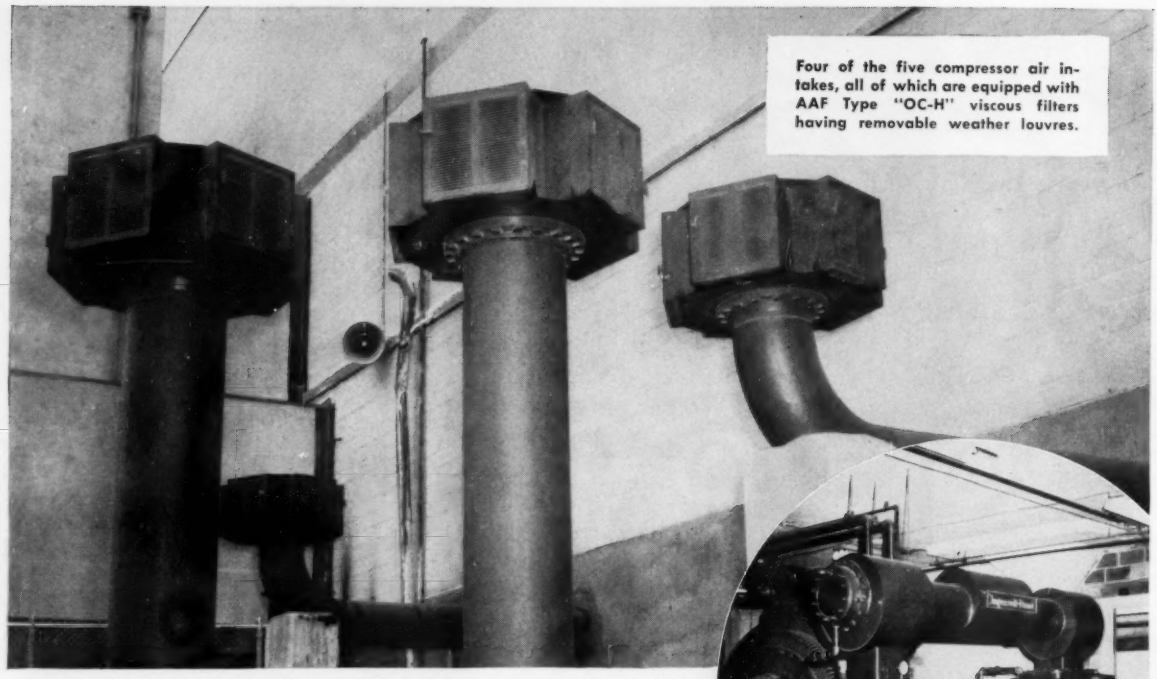
B-135

THE EIMCO CORPORATION

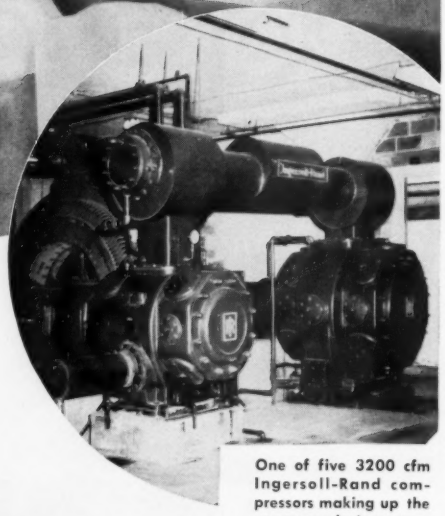
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

Circle 13A on reply card

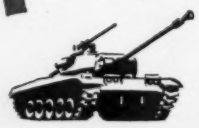


Four of the five compressor air intakes, all of which are equipped with AAF Type "OC-H" viscous filters having removable weather louvres.



One of five 3200 cfm Ingersoll-Rand compressors making up the compressed-air system.

FILTERS PROTECT TANK PLANT against air raids from dust



AAF "OC-H" Filters Stand Guard Over Compressed-Air System Serving More Than 2000 Tools

Compressed air is a mighty important commodity at Cadillac's Cleveland Tank Plant. Five 3200 cfm Ingersoll-Rand compressors provide the motive power for over 2000 air-tools and hoists used in producing the famous Walker Bulldog light tanks.

What havoc dust and dirt could play, here, if allowed free access to this vital system! But they're "stopped cold" at the air intake of each compressor by an AAF Type "OC-H" Filter. Selection of this viscous impingement type filter was based on several factors—ease of installation and maintenance, high cleaning efficiency with low resistance to air flow, large dust holding capacity and rugged construction.

Every engine and compressor user should make "clean air" a defense project—and AAF Filters his first line of defense against dust. There's a unit of a type and size designed to deliver clean air to your exact needs and specifications. Write today for complete catalog information.

AAF

herman nelson

American Air Filter

COMPANY, INC.

American Air Filter of Canada, Ltd., Montreal, P. Q. • 402 Central Avenue, Louisville 8, Kentucky

Circle 14A on reply card

AIRengineering at work
REPORT No. 4240.70

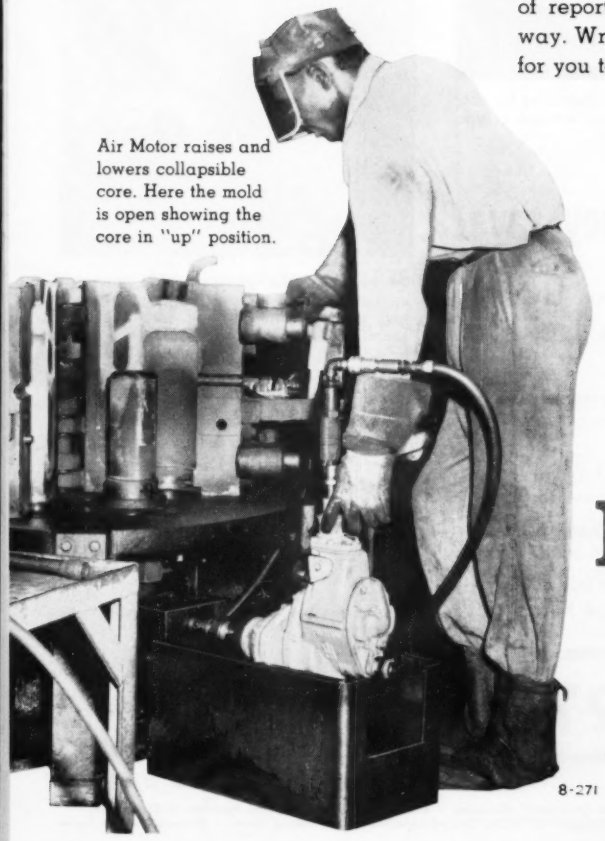
Air Motor Takes "Backache" Out of Molding Job...

SAVES $3.10 *a day..*

A large producer of aluminum parts had a number of strenuous jobs. One involved manually moving a four foot rack and pinion handle through a 200° arc to raise and lower a collapsible core in a book mold.

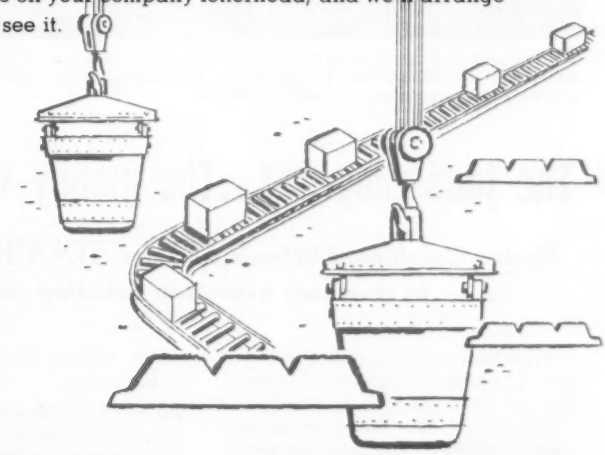
AIRengineering was put to work. An Ingersoll-Rand Size 55SO Air Motor was installed to operate the pinion. Production jumped from 180 to 220 pieces per day . . . workers no longer complained . . . and savings amounted to $3.10 a day. As a result, two more Air Motors were installed, with similar savings.

You may be the man who brings production or maintenance savings into your plant. A look at I-R's *confidential* manual of reports on "AIRengineering at work" could point the way. Write on your company letterhead, and we'll arrange for you to see it.



Air Motor raises and lowers collapsible core. Here the mold is open showing the core in "up" position.

8-271

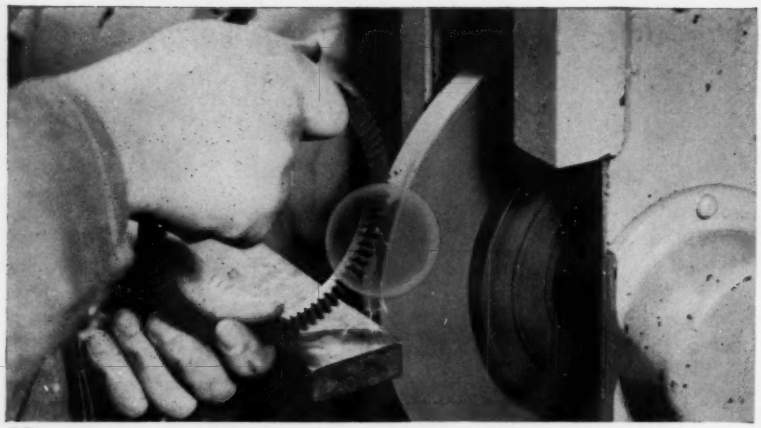


Ingersoll-Rand

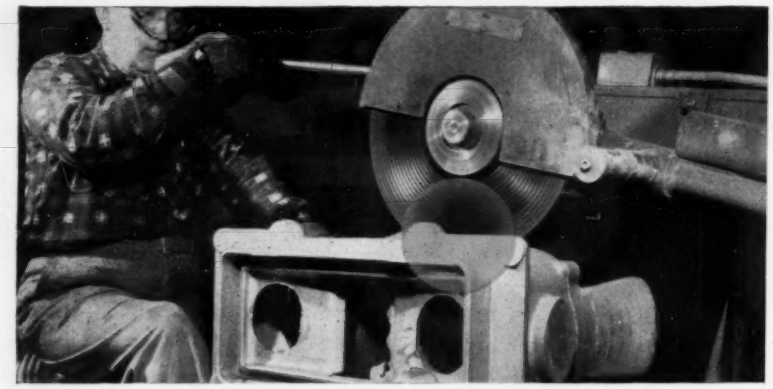
11 Broadway, New York 4, N.Y.

AIRengineering Manual

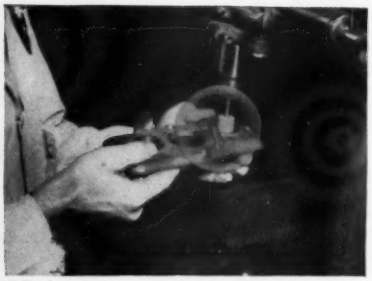
Don't miss over 100 interesting case history applications of AIRengineering in this confidential manual



BF A Universal favorite for removing light welds, breaking edges on machined work, deburring, taking off flash from plastic parts and many other light portable and bench grinding operations. To be used on periphery only.



BN The preferred cut-off wheel for non-ferrous and non-metallic jobs. Also excellent for cutting wire rope, slotting rails, tuck pointing, etc. Used on swing-frame and stationary type cutting-off machines, large and small portables.



BF MOUNTED WHEELS AND POINTS have the same strong laminated construction as the larger BF wheels. For polishing die cavities, chamfering, Brinell spotting, etc. For hand finishing, use BF sticks.

BD A specialist in heavier stock removal, such as welds on fabricated work, smoothing flame-cut edges, cleaning between teeth of gear castings, etc. — also for slotting, notching and cutting-off.

BFR Excels at the lighter portable jobs, such as rust and scale removal, light weld grinding, scarfing and beveling, blending contours, notching gates and risers.

The jobs they do!...The money they save!

Norton Reinforced Wheels add the "TOUCH of GOLD" *to countless everyday grinding jobs*

With Norton Reinforced Wheels you get extra-long service life, exceptional strength and fast, cool, trouble-free grinding — the Norton-engineered "Touch of Gold" that saves you money in the widest range of routine grinding jobs, from light deburring to heavy cutting-off.

To this top grinding performance Norton Reinforced Wheels add a wide margin of safety. All four are resinoid bonded and reinforced by layers of tough fabric molded into them. As follows:

BF — *Semi-flexible straight wheel, cotton fabric reinforcement. Also available in mounted wheels, points and hand sticks.*

BN — *Straight wheel with glass cloth reinforcement. Primarily a cut-off wheel, its rough, knurled sides provide additional cutting action.*

BD — *Rigid hub-type. Glass cloth and Nylon reinforcement. Designed especially for right angle portables and disc sanders.*

BFR — *Semi-flexible hub-type. Cotton fabric and Nylon reinforcement.*

SEE YOUR NORTON DISTRIBUTOR

for a demonstration of Norton Reinforced Wheels in your shop. Ask him for the big new catalog on Reinforced Wheels. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

Making better products . . . to make your products better

W-1638

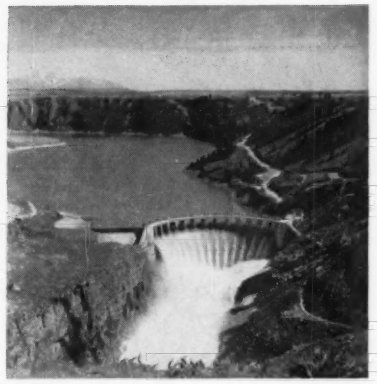
NORTON

and its BEHR-MANNING division

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

Circle 16A on reply card

ON THE COVER



Here's the dam, but where's the powerhouse? Look below and . . .

KERR Dam in northwestern Montana impounds water of the Flathead River to generate electricity that is distributed over much of the state by the Montana Power Company. The powerhouse is the largest of twelve hydroelectric stations owned by the utility, which also has one steam-operated plant. The system's capacity is 586,000 kw.

We first saw our cover picture in another publication. Its beauty appealed to us and we sought a copy. R. Richard Engstrom of the power company's advertising department obligingly sent a print from the firm's general office in Butte, Mont. It was accompanied by a caption explaining that a third generating unit of 56,000-kw size was installed in the powerhouse in 1954, thereby increasing its capacity to 168,000 kw.

The picture was nice, but we couldn't see the power plant, so we queried Mr. Engstrom about it. He patiently sent us a second photograph, which is reproduced below. He pointed out that the station is downstream from the dam and around a rocky point and that it is therefore difficult to get a good shot of both structures. After looking at the two pictures we are sure you will agree with him.

Dam and powerhouse are connected by three underground draft tubes or penstocks approximately 800 feet long.

here you see it, around the river bend at the right.

Compressed Air Magazine

COPYRIGHT 1955 BY COMPRESSED AIR MAGAZINE COMPANY

VOLUME 60 **August, 1955** NUMBER 8

G. W. MORRISON, *Publisher*
C. H. VIVIAN, *Editor* J. W. YOUNG, *Director of Advertising*
ANNA M. HOFFMANN, *Associate Editor* J. C. PIERCE, *Advertising Mgr.*
R. J. NEMMERS, *Assistant Editor* FRANCIS HARTMAN, *Circulation Mgr.*
J. J. KATARBA, *Business Mgr.* WILLIAM HEINS, *Foreign Circulation Mgr.*
D. Y. MARSHALL, Europe, 243 Upper Thames St., London, E. C. 4.
F. A. McLEAN, Canada, New Birks Building, Montreal, Quebec.

EDITORIAL CONTENTS

Progress at Bersimis—*J.P. Smallwood* . . . 224
Compressed Air vs Drought—*Abraham Streiff* . . . 232
Air-bag Wheels Smooth Out Bumps . . . 236
Pretzel-twisting Goes Mechanical—*Jane S. Muller* . . . 238
Editorials—Bogus Spare Parts—A Name Is Changed . . . 241
This and That . . . 242
Emptying Salt Bath with Air Under Pressure . . . 243
Compressed Air on a Mercy Mission . . . 243
Industrial Notes . . . 244
Quotes from Here and There . . . 249
Books and Industrial Literature . . . 252

ADVERTISING CONTENTS

Adams Co., Inc. R. P. . . . 30
Allis-Chalmers Mfg. Co. . . . 36
American Air Filter Co., Inc. . . . 16
Armstrong Machine Works . . . 19
Bethlehem Steel Company . . . 14
Bucyrus-Erie Company . . . 33
Continental Motors Corporation . . . 24
Crucible Steel Co. of America . . . 4
Diehl Manufacturing Company . . . 13
Dixon Valve & Coupling Co. . . . 23
Dollinger Corporation . . . 3
du Pont de Nemours & Co., E.I. . . . 5
Eimco Corporation, The . . . 15
Electric Machinery Mfg. Co. . . . 7
General Electric Company . . . 32
Hercules Powder Company . . . 37
Hills-McCanna Company . . . 31
Ingersoll-Rand Company
6, 11, 17, 26, 3rd Cover
International Nickel Co., Inc. . . . 12
Lake Shore Engineering Co. . . . 35
Lehigh, Inc. . . . 22
Madison-Kipp Corporation . . . 8
Naylor Pipe Company . . . 27
New Jersey Meter Company . . . 31
N.Y. & N.J. Lubricant Co. . . . 21
Niagara Blower Company . . . 29
Norton Company . . . 18
Punch-Lok Company . . . 30
Sauerman Bros. Inc. . . . 20
Schrader's Sons, A. . . . 10
Shell Oil Company . . . 25
Texas Company . . . 2nd Cover
Timken Roller Bearing Co.
Back Cover
United States Rubber Company . . . 34
Waldron Corporation, John . . . 28
Walworth Company . . . 9
Wood's Sons Co., T.B. . . . 31

A monthly publication devoted to the many fields of endeavor in which compressed air serves useful purposes. Founded in 1896.

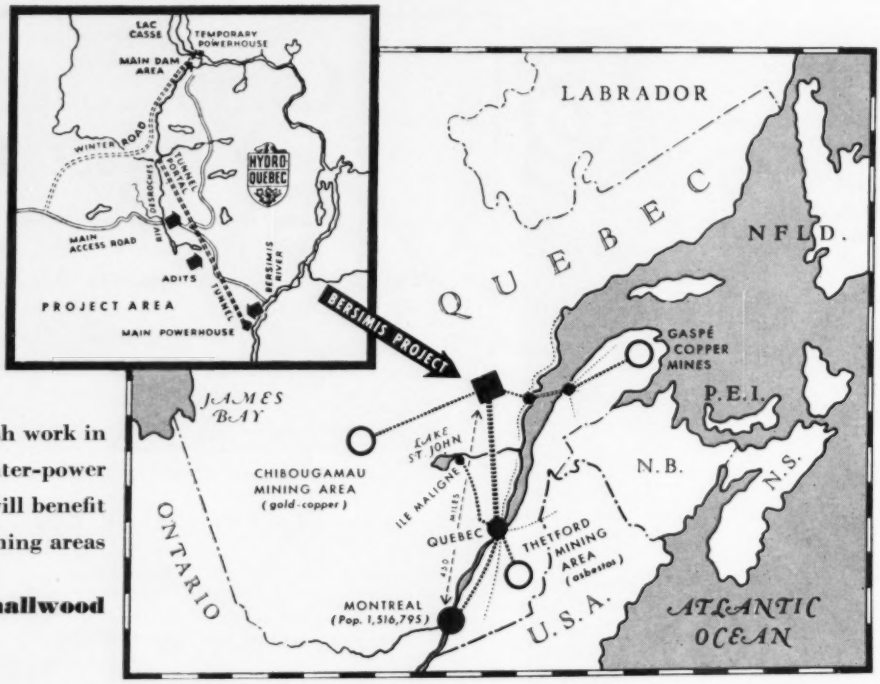
BPA Member Business Publications Audit of Circulation, Inc.

Published by Compressed Air Magazine Co., G. W. MORRISON, *President.*
C. H. VIVIAN, *Vice-President.* A. W. LOOMIS, *Vice-President.*
J. W. YOUNG, *Secretary-Treasurer.*
Editorial, advertising, and publication offices, Phillipsburg, N. J.
New York City Office, 11 Broadway. L. H. GEYER, *Representative.*
Annual subscription: U.S., $3.00, foreign, $3.50. Single copies, 35 cents.
COMPRESSED AIR MAGAZINE is on file in many libraries and is indexed in Industrial Arts Index and in Engineering Index.

PROGRESS AT BERSIMIS

Four thousand men push work in Canada on huge water-power project that will benefit several mining areas

J. P. Smallwood

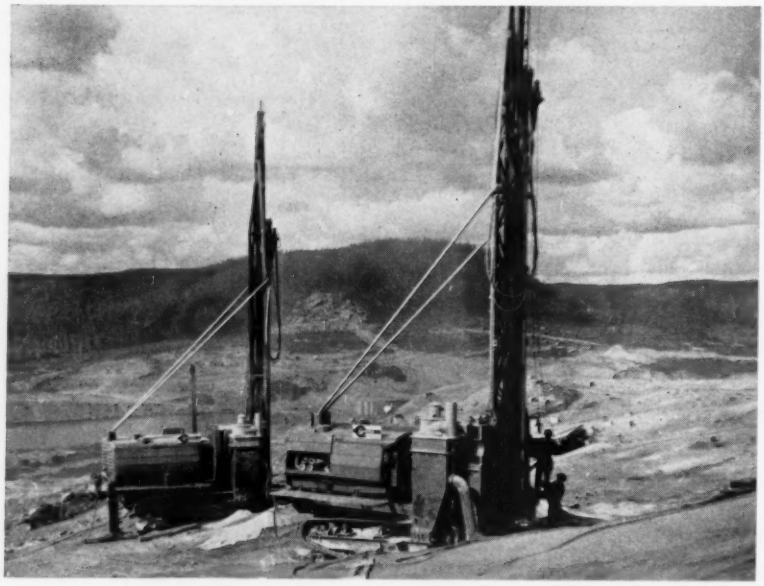


MAP OF AREA AFFECTED

Circles on the large map indicate sections that will receive Bersimis power. The inset shows the construction area. Two dams near the junction of the Bersimis and Des Roches rivers will create a storage basin from which water will flow through a 7½-mile tunnel and drop 870 feet to spin eight 150,000-hp generators in an underground powerhouse. The final unit is to be installed in 1961. Another hydro station, which is to have a capacity of 800,000 hp, will be built downstream later on.

TWENTY years from now Quebec will be the leading mineral producer of the Canadian provinces provided its current rate of expansion is maintained—a strong possibility based on two economic-geographical factors.

The first clincher in this prediction is the existence of a solid base of well-established active mines, properties now coming into large-scale production and a remarkably favorable geology for the discovery of many more valuable deposits. Except for a relatively small alluvial region comprising the St. Lawrence River lowlands, Quebec is largely rock. It consists of a headland of the Appalachian Mountains jutting into the southeast corner and of the vast pre-Cambrian rock shield of the Laurentian Mountains which covers nine-tenths of the province.



BIRTH OF A QUARRY

The Angus Robertson Company is quarrying 5,000,000 cubic yards of rock for dam building. Heavy drilling is done by two Quarrymasters. Large diameter holes are usually around 56 feet deep, but sometimes reach 73.

The second factor in Quebec's increasing success in the mineral business is that this same mother rock contributes an abundance of hydroelectric power depending primarily on a series of natural catchbasins in lush watersheds. Considering the progressive attitude of the government in regard to water power, this means that mine operators will be assured adequate low-cost current to run compressors, hoists, crushers, conveyors and other mechanisms—all that the kilowatt-hungry equipment needs to get ore out of the ground and to process it. In this field Quebec is in the lead with well over half of all developed hydroelectric energy in Canada to date, plus first-rank potential—a possible 26,500,000 hp.

The most significant single contribution to the power phase of the province's mining ascendancy will be the giant Bersimis River Project.* This job of harnessing 1,900,000 hp in two backwoods

*"Power from the Bersimis," Compressed Air Magazine, May 1954

plants 450 miles from Montreal is in progress at the very hub of an area encompassing a fortune in minerals and was started by the Quebec Hydro-Electric Power Commission in the summer of 1952.

Sometime in 1961 when the last switch is closed in the first station—a huge underground powerhouse with a capacity of 1,200,000 hp—a block of 400,000 hp will be carried across the St. Lawrence River by submerged cable to Gaspe Copper Mines Limited, a subsidiary of Noranda Mining Company. Another 400,000 hp will be coursing northward through the lines of Shawinigan Water & Power Company's Saguenay River system to serve the rapidly growing Chibougamau mining camp. This same hook-up will also provide more electricity for the asbestos operations in the rich Thetford Mines area in Quebec's eastern townships.

Not yet on the books for Bersimis power but well within sight are the great iron fields off to the northeast. These, and the valuable copper discoveries recently in the news, have made the possibility of future hydroelectric development in the region more than an idle rumor. In fact, test drilling and bulk sampling are underway by the Hollinger-Hanna Company which flew in 154 tons of equipment, including a small crusher, late last winter.†

Even now the Iron Ore Company of Canada, which went into production in August of 1954, places strong reliance on waterpower to make its operations economically feasible. This vast open-pit property, with its 360 newly constructed miles of railway from Seven Islands north into Quebec, is served by two hydroelectric stations built as part of the $200,000,000 project. One of these on the Marguerite River near Seven Islands supplies 23,000 kw for the ore-loading facilities and rail marshaling yards at tidewater. Farther north is the Menihek Lake Station which produces 10,000 kw for the mine, crusher plant and town at Knob Lake.

There is no doubt that Noranda's plans for its copper mines on the Gaspe Peninsula would be on a much smaller scale except for the availability of power from the Bersimis in the near future. With proven deposits of 67,000,000 tons of 1.45 to 1.76 percent copper ore valued at $400,000,000, this property will receive current from a 31-mile transmission line extending underwater from Chute Aux Outardes on the north shore of the St. Lawrence River to Les Boules near Matane on the south shore. Putting Gaspe copper into production will cost $35,000,000 and necessitate a construction force of more than 1700 men. The present schedule calls for the milling of 6500 tons of ore daily and the smelting of 400-500 tons of copper concentrates per day—all production to get underway this year.

Off to the Northwest deep in the taiga forest beyond Lake St. John lies the gold-copper mining area of Chibougamau which is being brought back to life. This region, which boomed in the 1920's and then collapsed for lack of power and adequate transportation, has taken heart with the promise of electric energy from the Bersimis. The first producing property, Opemiska Copper, has been operating a 400-ton mill for the past year at a profit of $1,300,000, and plans are afoot to raise the output to 450-500 tons per day.

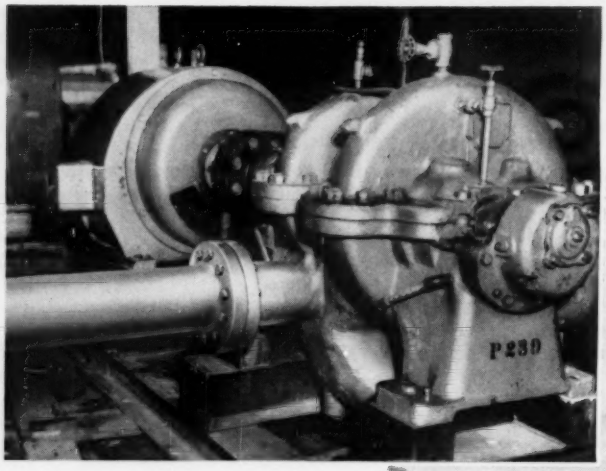
Until a 150-mile, 154,000-volt Hydro-Quebec transmission line reached Chibougamau from Dolbeau at the head of Lake St. John, Opemiska, like all other mines in the area, was forced to provide its own power at considerable cost by diesel engine-driven generators. Already, the prospect of electricity from the Bersimis is a big factor in establishing Chibougamau as a permanent camp on Quebec's mining map.

The arrival in June of hydro power at another important property, Campbell-Chibougamau, put its big mill and concentrator into immediate production of

†"Iron Ore from Labrador," Compressed Air Magazine, July and August 1954

PIERCING A MOUNTAIN

Three contractors divided the work of boring 7½ miles of 35-foot-diameter tunnel which will be lined with concrete to an inside width of 31½ feet. They used six drill carriages, or jumbos, each mounting from 20 to 22 Ingersoll-Rand DA-35 drifter drills on individual hydraulic booms. The view above of a supported stretch of the tunnel driven by the Atlas Construction Company shows a jumbo which was mounted on a pneumatic-tired Athey wagon and drawn by a tractor. The driller seen close-up, left, doesn't seem to mind a little water as he watches his machine pound away on one of the 100-odd holes in the round.



DAM BUILDING WITH WATER

Rock placed in the two dams is jetted with powerful streams of water that wash away the fine material and insure good compaction. The water is taken from the Bersimis River and delivered under pressure by I-R pumps such as the one shown at the left.

copper concentrates to fill a contract calling for the delivery of up to 63,000,000 pounds to the U. S. Government's Stockpiling Agency. Campbell has ore resources amounting to some 1,900,000 tons containing 2.98 percent copper and 0.085 ounces of gold per ton. So far, underground work has yielded 100,000 tons ready for treatment in a new mill with a daily capacity of 1750 tons.

Another promising mine of the 100-odd companies holding claims in the Chibougamau district is Chibougamau Explorers Limited which is now building a 500-ton-a-day electric mill. Its ore reserves are estimated at 561,369 tons averaging 0.29 ounces of gold and 0.73 percent copper per ton. The expected yearly gross recovery is $2,658,000, or $14.65 per ton.

Indirectly, but no less effectively, power from the Bersimis will serve still another important mining center in Quebec—the asbestos mines around Thetford. That area is at present receiving current over a 60,000-volt, 2-circuit transmission line in the Shawinigan Water & Power Company system. It is generated in a station located at Chaudiere on the outskirts of Quebec City and tied in with another powerhouse at Ile Maligne near Lake St. John. When the Bersimis project is completed, the block of energy now available for operations at Thetford will be supplemented by 400,000 hp, which has already been contracted for by Shawinigan. Close to a million tons of asbestos fiber, valued at $87,000,000 in 1954, is shipped from there annually, 97 percent going to the United States.

The Canadian Johns-Manville Company Limited is the leading operator among the eleven mines which roughly accounted for one-third of Quebec's entire mineral output last year. J-M's Jeffrey asbestos producer is the world's largest and has the biggest mill with an annual capacity of 635,000 tons of fiber. It was put in service in 1954.

Other important steps being taken in the asbestos district include the $25 million job of draining Black Lake to uncover 50 million tons of ore belonging to the United Asbestos Corporation. Opening the deposit will necessitate the diversion of the incoming streams, the removal of 30 million cubic yards of clay, sand and gravel now blanketing the lake bottom and the relocation of a main highway.

With increased output as the goal, other mines in the area are busy converting from open-pit to underground operations. Three major producers at Thetford are spending $5,000,000 in a coöperative effort to extend their workings by moving a whole section of the town. The three involved are Bell Asbestos Mines Limited, The Asbestos Corporation and Johnson Company Limited. In all, the asbestos industry in Quebec has underway $70,000,000 worth of new construction and improvements which are largely the outcome of the Bersimis Power Project.

Taking 1,200,000 hp from a mountain-and-water complex of virgin wilderness is an undertaking ranking with others of our day such as the Alcan job in British Columbia and Ontario Hydro's Sir Adam Beck No. 2 Station at Niagara Falls. Their similarity with the Bersimis development becomes evident as we follow its fundamental phases which constitute projects within projects.

First there are two huge dams on the Bersimis and Des Roches rivers. These will form a reservoir with a capacity of 385 billion cubic feet (884,000 acre-feet) to store the waters of Lac Casse and Pipmaucan Lake. Cut-off dams are required at the western end of the basin to prevent water from the Bersimis backing up into the neighboring watershed. The impounded water between elevations 1275 and 1300 will be usable and follow a natural channel from Lac Casse to the intake of a concrete-lined tunnel that will convey it to the main powerhouse. The bore will be 7½ miles long and have a finished diameter of 31½ feet. The regulated flow through the system will total 9320 second-feet.

The Bersimis Dam will be the larger of the two. It will be 2100 feet long, 200 feet high, 900 feet wide at the base and 40 feet at the crest. The structure on the Des Roches will be 200 feet high, 1035 feet long and have a base width of 825 feet. Both of earth-and-rock fill construction, a small mountain nearby is being leveled to provide the 5,000,000-odd cubic yards of rock that will be required to build them.

To speed up the job, jets of water are being used to compact the rock fill. For a given quantity of rock deposited on the dams about three times as much water is applied by monitors to sluice it into place and to wash out fines. River water for this operation is delivered under pres-

sure by pumps: Cameron Model 6-GT's for the first lift and high-pressure 6-ALV's for the succeeding ones.

At the outset, Canadian Ingersoll-Rand Jackhamers and wagon drills were used to cut a working face about 20 feet high in the quarry. Then Angus Robertson Company, the contractor for the dams, resorted to the coyote-tunnel method, using J-50 Jackhamers mounted on Jacklegs and C-I-R scraper hoists both for mucking the tunnels and loading them with powder. The hoists were ideal for the purpose because they have lots of power and a narrow pull drum and a medium-size tail drum. Each was driven by a 5-cylinder air motor.

As quarrying progressed, a 50-foot face was established and drilling methods were changed. Two Ingersoll-Rand self-propelled Quarrymaster units were added to the equipment and put down large-diameter vertical blastholes to an average depth of 56 feet. At times, when surface irregularities require deeper holes to maintain the height of the face, they penetrate up to 73 feet. The blasted rock is loaded by 4-cubic-yard Marion and P&H electric-driven shovels into Euclid, White and Autocar trucks for haulage to the dumping area.

On June 8, the Honorable John S. Bourque, Quebec's Minister of Hydraulic Resources, set off the remaining charge of dynamite that effected the final breakthrough of the 40,139-foot-long Bersimis tunnel. The event took place a little past the halfway mark, and when the smoke had cleared the engineers found that the opposing headings were just ⅛ inch out, a tribute to them and to the hard-rock miners who had toiled eighteen months in driving the 35-foot-diameter hole through the Laurentians. It was advanced from seven headings by three contractors:

Cartier Construction Company on the east end excavated 16,050 feet of tunnel and 2660 feet of adit from three headings—one for the intake and two farther along the line.

Atlas Construction Company had the contract for the midsection and drove 16,050 feet from an east and a west heading. Of this quantity 2500 feet was adit.

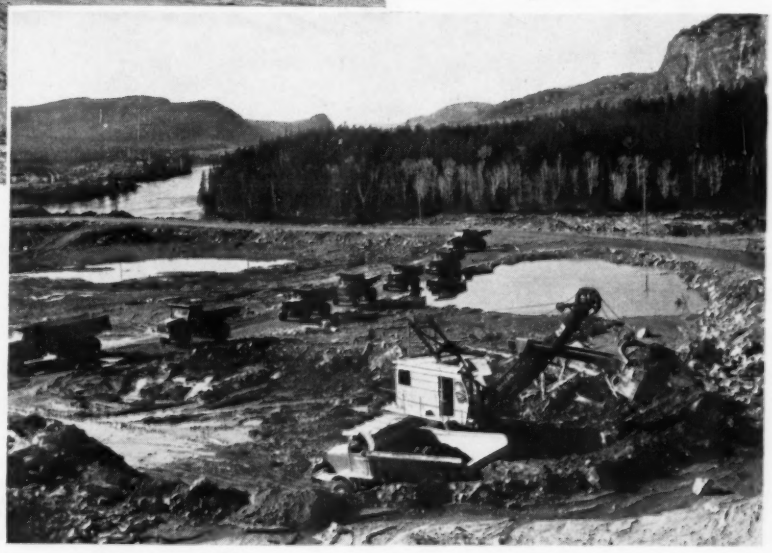
Perini (Quebec) Ltd., at the discharge end, worked westward toward the Atlas job and east to the point of meeting with the penstocks. This company also holds the contract for the powerhouse rock work, making a total of about 9000 linear feet of tunnel, penstocks, surge shaft, main power plant and tailrace.

The six drill carriages that were used in driving the tunnel were almost identical, each mounting 20 to 22 DA-35 power-feed drifters on hydraulic booms designed and built by Canadian Ingersoll-Rand Limited. Electric shovels with short booms loaded the muck into large dump trucks that passed through swing decks on the jumbos.

The granitic-gneiss rock penetrated proved to be remarkably consistent throughout and this permitted using essentially the same drilling pattern—a modification of the "burn" cut—at all faces. A typical round consisted of 100-odd holes. Several 3-inch holes were drilled 21 feet deep in the center and not loaded with powder. This gave the rock something to break to when the explosive in the surrounding holes was detonated. The Cartier Company instituted this method, which was adopted by the other contractors who had been drilling burn holes 2 inches in diameter.

Cartier and Atlas started all other holes with 2-inch bits and stepped down the gauge slightly each time a change was made to a longer steel, which was done at depths of 5, 9, 13 and 17 feet. The Perini crews used 2⅛-inch starters and followed with 2- and 1⅞-inch sizes.

(*Text continued on page 230*)



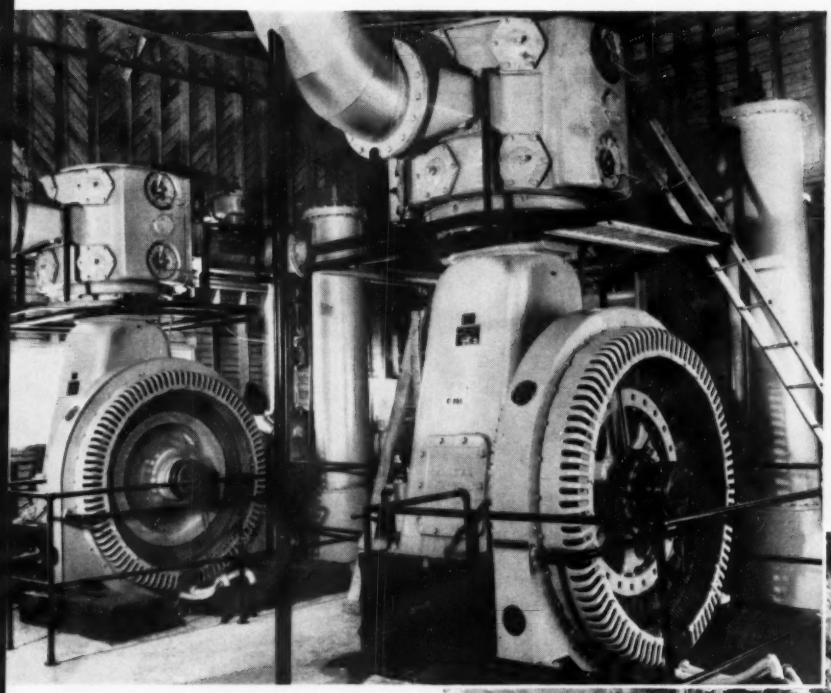
POWERHOUSE IN A MOUNTAIN

The Euclid truck shown above had just come out of the adit leading to the huge underground cavern being carved out for the powerhouse. Measuring 565 feet long, 65 feet wide and 80 feet high, the opening will house eight 150,000-hp turbogenerators. After spinning the turbines, the water will issue from the mountain through a 760-foot tunnel and then enter an open tailrace that will lead it back to the Bersimis. Pictured at the right is the beginning of the tailrace excavation, with the river at the upper-left.

Glimpses of Bersimis

Local construction materials are used wherever possible. This loghouse serves well as a magazine for dynamite. The signs give warning of danger in both English and French.

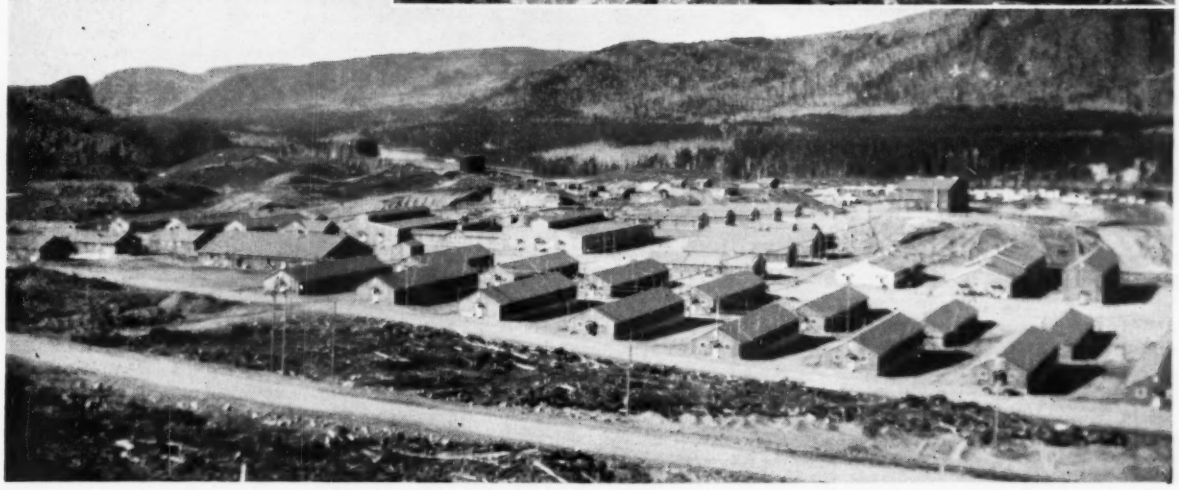
Here began the taming of the Bersimis River. This was the scene soon after work started on the largest of the two dams which, together, will ultimately impound 2889 billion gallons of water. The boxlike structure above and right of the center is the concrete intake of a tunnel that conducts some of the water 1700 yards downstream to turn generators that are supplying 15,000 hp needed on the construction project. Thus the river is helping to bring itself under control. Surplus flow follows a diversion channel between the near bank and the cofferdam area.

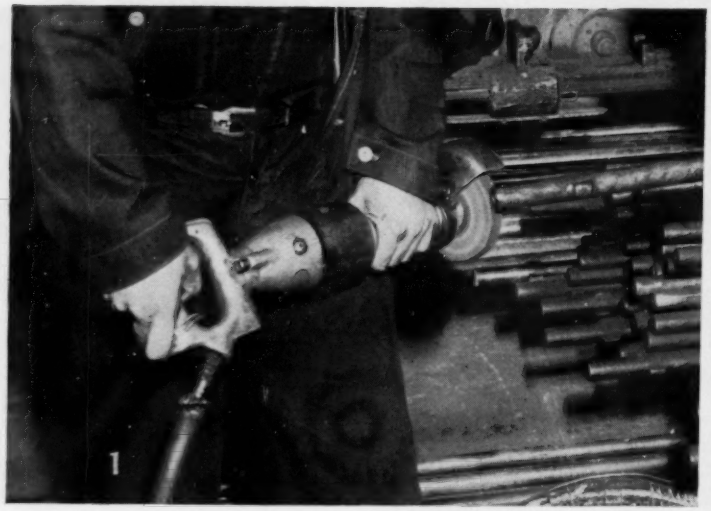


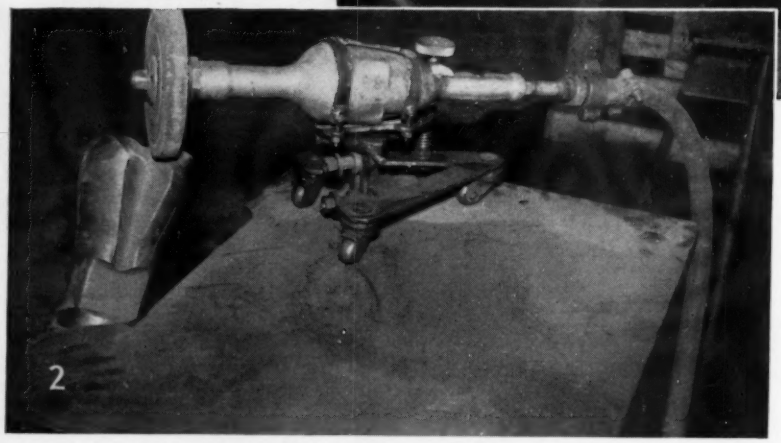
Sixteen Ingersoll-Rand portable compressors were in the first boatloads of equipment sent down the St. Lawrence River to the construction site. They got the job started, but as the tempo increased and more air was needed stationary units were set up. A separate powerhouse containing two or more Canadian Ingersoll-Rand compressors such as those pictured (left) was established near each of the three tunnel adits and at the quarry.

Below is shown an I-R wagon drill putting in a toe hole at the tunnel intake workings while a shovel loads a truck with blasted rock. Barely discernible beyond the truck on the hillside Jackhamer operators are clawing away at the actual site of the intake.

This is a "big-league" construction job, a $225 million undertaking being pushed at a fast pace in a sparsely settled section far from city comforts. Work goes on night and day, winter and summer. The more than 4000 men on the Bersimis project include hard-rock miners, electricians, cooks and chore boys. Most of them live in Labrieville (below), a town that sprang from the ground, complete with hospital, churches, movie houses and bowling alleys.







Carset (tungsten carbide-insert) bits served throughout. The best progress recorded was an advance of 436 feet in one week from two headings by Cartier. Forty percent Forcite powder was used under normal blasting conditions and 70 percent when tight ground was encountered, both packed in 1¼x8-inch cartridges. Consumption was at the rate of approximately 3½ to 4 pounds per cubic yard.

Excavated material was piled close to each adit, providing quick truck turnround and a tight mucking cycle. Near the face the trucks were reversed on a metal skid table with the aid of a C-I-R tugger (electric) hoist. This permitted them to be backed up quickly to the shovel for loading and not only saved time but helped to cut down confusion at a busy spot where a maintenance crew was sometimes at work on the jumbo, if not electricians and other follow-up men trying to get their jobs done near the face.

Hydro-Quebec engineers estimate that the boring of the Bersimis Tunnel has required the removal of some 2,200,000 cubic yards of rock and that it will take about 2,240,000 bags of cement to make the 407,000 cubic yards of concrete needed to line the bore. This work is well underway. First a concrete curb was placed on each side on which the form is pulled along by two Model BU Tugger hoists. Next comes a Pumpcrete machine which receives the mix from trucks and delivers it to the pouring area. For the return trip to the central batching plant, situated midway along the tunnel line, the trucks are turned on a skid table with an air hoist, the same as in the mucking operation.

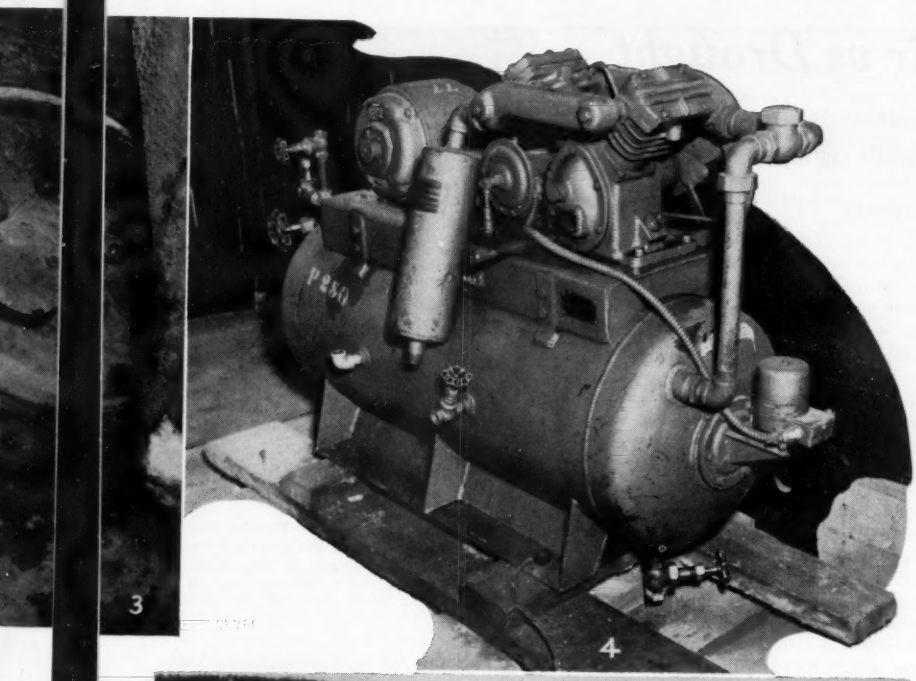
The Bersimis Powerhouse is the first one in the province to be located in an underground chamber. The latter is 565 feet long, 65 feet wide and 80 feet high. Though exceeded in size perhaps only by the recently excavated cavern for the Alcan station at Kemano in British Columbia, it will house the world's largest hydroelectric generators—eight 150,000 units supplied by the English Electric Company. They will be driven by Francis water wheels and produce power at 13,800 volts, 60 cycles. Two 1000-kva transformers will be provided to bleed off enough energy for plant requirements, including the operation of a 400-ton traveling crane without which the huge generators could neither be installed nor maintained.

At this writing the rock work on the powerhouse, penstocks, surge shaft and

COMPRESSED AIR—A READY SERVANT

Compressed air's main job at Bersimis is to power the rock drills that put in many miles of blastholes for tunneling, quarrying and other kinds of rock excavation. But, as is usually the case on construction projects of this magnitude, it performs countless other services of many kinds.

- In the four shops that are completely equipped to take care of drill rods and bits, air power is a helpful servant. For example, in the Atlas Construction Company's shop an I-R Multi-Vane grinder (No. 1) bevels the shank ends of the rods which are struck some 2000 blows a minute by the drill pistons.
- In the Angus Robertson shop an I-R grinder has been set up on a small movable carriage (No. 2) to facilitate dressing the tungsten-carbide inserts that form the cutting edges of a Quarrymaster bit.
- Keeping trucks, tractors and other rolling equipment on the go calls for regular attention. A size 534 Impactool (No. 3) speeds the job of running retaining nuts on and off when tires have to be changed.
- Large stationary compressors (see preceding page) are furnishing most of the air required, but smaller units are scattered about the job in areas not reached by the distribution lines. The I-R 5-hp machine shown in No. 4 serves one of the vehicle repair shops.
- Other applications call for portable compressors such as the 80-cfm unit (No. 5) that is hustled about the construction town of Labrieville. When photographed, it was furnishing power for running clay spades being used to excavate trenches for water mains.



tailrace is nearing completion. Access to the station site was obtained by driving an adit by aid of two jumbos each equipped with nine DA-35 drifters mounted on booms. A short distance inside the mountain it branches, one fork leading to the chamber area and the other angling off on a tangent to the tailrace tunnel. Some bad ground was encountered in advancing the tailrace branch and necessitated first roof bolting with an R-38 stoper and 534 impact wrench and then guniting. Excavation of the powerhouse cavern has been mainly a benching operation and was started at the west end with a special Athey wagon-mounted 9-drill jumbo pulled by a tractor. The penstocks and surge chamber are full-face drilling jobs using R-38 stopers. Of the eight penstocks, four are finished. They vary in diameter from 9 to 12 feet.

After passing through the Francis turbines, the water will flow back to the Bersimis through the tailrace—a tunnel 760 feet long, 78 feet high, and 48 feet wide and a V-shaped open cut that widens by degrees on its way to the river. This work has called for drilling, blasting and hauling nearly 1,100,000 cubic yards of rock: 100,000 in driving the underground conduit and about a million in digging the open section. Some difficulty is being experienced in constructing the part of the tailrace adjacent to the stream. There the formation is sandy and involves sinking a cofferdam to a depth of 80 feet.

The powerhouse control room will be in an imposing 3-story structure located outside of the underground chamber and near the transformer and switching station. That building will also contain offices for the plant personnel and for Labrieville's administrative forces.

The transformer and switching station will cover an area of 300,000 square feet near the entrance to the powerhouse and will rise between the mountain and the river. It will house twelve 40,000-kva single-phase transformers to increase the voltage from 13,800 to 300,000 for transmission, seven air-blast circuit breakers, and thirteen disconnects to control as well as shift current between two transmission lines. In addition there will be two transformers in the town to lower the voltage from 13,800 to 4000 to supply its domestic needs.

Because of the remoteness of the Bersimis project from centers of habitation, the transmission-line phase of the development is an important factor. It entailed considerable preparatory work, including an aerial survey of 400 linear miles. Photographs were taken from a helicopter and were laid out as a continuous picture on a scale of 1000 feet to 1 inch.

More than 10,000 heavily wooded acres must be cleared in constructing the two lines. The right of way for the 161,000-volt line to the jumping off place for the St. Lawrence River crossing will be 150 feet wide, and the other extending to Quebec City will be twice as wide. As the country is predominantly hilly, if not mountainous, the handling of equipment also will present difficulties.

Except for the Saguenay River crossing, the towers will be about 138 feet high and the average span 1000 feet. There 200-foot towers will be erected on 600-foot cliffs and the line strung between them will have a span of 5000 feet. Even then the clearance at mean water level will be only 170 feet.

And so a power giant, the Bersimis, whose untamed waters mingled with those that swept past Jacques Cartier's ships as they proceeded up the St. Lawrence into a mysterious new world, is coming into its own—is making a vital contribution to Quebec's mining industry and to a civilization based on a technology for the good of mankind.

Compressed Air vs Drought

Bubbles released at lower reservoir levels would bring cool water to the surface and markedly reduce evaporation

ABRAHAM STREIFF

DR. ELWOOD MEAD

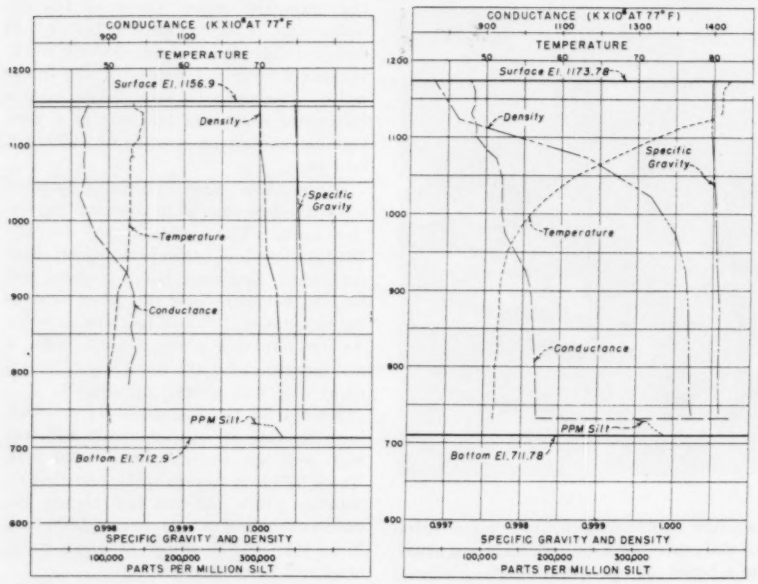
One of the nation's great exponents of water conservation. While commissioner of the Bureau of Reclamation (1924-36) he initiated some of the foremost irrigation projects in the West. Lake Mead, formed by Hoover Dam on the Colorado River, is named for him.

TRAVELING Southwest in midsummer from the lush green fields, cool pine woods and limpid lakes of Maine, vistas of verdure soon commence to spread out into Midwest farm flatlands already flecked with yellow, stubbled harvest fields and browning, sunburnt grass areas. Still farther along in the dry belt arid perspectives loom and pass and dust clouds, wind-blown from sandbars green-fringed only where water reaches thirsty roots, trail over hidden distant rivers.

The "expanding and contracting desert," as Isaiah Bowman referred to the climatic pendulum, once more swirls dust over vast reaches from Texas to Wyoming. For thousands of years man has dwelt, seemingly by preference, in regions of dwindling rains; indeed, civilization was born where rains begin to tarry and turn back. The Near East deserts are inexhaustible ruin histories of once thickly settled, irrigated empires that rose and fell in a bewildering succession from one millennium to the next. For 6000 years irrigated realms have driven the desert hard to its sovereign haunts. The sagebrush-covered open spaces of dry plain and rock-strewn wasteland in the United States still remain and were marked the "Great American Desert" on old maps of the West.

Though much has been accomplished through modern engineering efforts, we still waste too much of that most precious of all elements—water. Half a century ago, Major Sir Hanbury Brown wrote about Indian irrigation: "If all the works conceivable are constructed in the Punjab and the Sind, 60% of the surface flow would still escape by the rivers to the sea." Fifty years later Prof. O.W. Israelsen stated in a book on irrigation that less than one-third of the water diverted for irrigation is consumed by growing crops. Waste of water continues unabated.

In U.S. Geological Survey Circular 229 (1952), the former Commissioner of Reclamation, M.W. Strauss, said: "Lake Mead is the key reservoir for the distribution of Colorado River water to Arizona and portions of Nevada, Utah and New Mexico. Without water this area would almost be uninhabited, and the bulk of the supply comes from the Lower Colorado. Every drop is precious; the demand far exceeds the supply. For this reason the Bureau of Reclamation is obligated to remove every possible source of error in its handling of the water of Lake Mead. The evaporation loss cannot be prevented, but accurate knowledge of evaporation permits more efficient use of the remaining water."



TEMPERATURE VARIATIONS IN LAKE MEAD

Two of the monthly graphs that are prepared as a part of Lake Mead density-current studies conducted by the U.S. Bureau of Reclamation. Among other things, they show the water temperature at various depths. On the chart at the left, made in February 1950, it will be noted that the water temperature varied less than 10° between the bottom and the surface. However, in August of the same year, as the second graph indicates, the water was approximately 30° cooler in the lower 275 feet of the reservoir than it was at and near the surface. The author points out that compressed air released at the lower levels would bring this cooler water to the top and thus reduce evaporation considerably.

Loss through evaporation is stupendous. According to the report of river control work and investigations, Lower Colorado River Basin, the annual evaporation measured by floating pans and corrected for rainfall is about 100 inches, or 8.35 feet. For the 120,000-acre surface area of Lake Mead this amounts to a million acre-feet per year. For all the reservoirs in the Southwest the combined loss is, indeed, serious. Fortunately, the actual recorded loss between inflow and outflow is much smaller, and the figure given is the maximum rate of evaporation during the hottest months of the year during which corrective measures, as herein discussed, should be applied.

An editorial that appeared in the October 1948 issue of this magazine under the title *Precious Water* reviewed the situation clearly. As therein foreseen, the water problem has increased in scope. The value of one million acre-feet of water is emphasized by the fact that the 912-foot-high Grand Dixence Dam is being constructed in Switzerland in order to impound 40,000 acre-feet of water. Exceeding Hoover Dam in height (726

feet), it is being built to store only one twenty-fifth of the amount of water lost by evaporation in Lake Mead alone!

The late Commissioner of Reclamation Elwood Mead wrote in 1904 that "a California spring flowing one cubic foot per second recently sold for $50,000." At that rate, and allowing for the devaluation of the dollar since then, the water lost through evaporation at the Hoover Dam Reservoir, which is equivalent to 1382 cubic feet per second, might be valued at $346,000,000 today. Water for Texas rice culture costs some $13 per acre-year, while that supplied by the Colorado Aqueduct when constructed was estimated at $18 per acre-foot.

The Government's saline-water program has set a limit of twelve cents per 1000 gallons, or $39 per acre-foot, for irrigation water. In the Neches Valley in Texas, located in the rain belt near the Louisiana border, the industrial water rate is already $50 per million gallons for quantities of one million a day, with a minimum monthly payment of $1500. Near Corpus Christi it was 24 cents per 1000 gallons, or $78 per acre-foot, four years ago.

Obviously, the price of water is climbing under the pressure of rapid depletion and insatiable demand. Decreasing the losses is equivalent to increasing the supply. If evaporation cannot be prevented it might possibly be reduced. Nature herself shows us on a vast scale how this might be brought about. For a solution let us travel to the shores of the Caspian Sea, which is about 730 miles long and 260 miles wide. This large body of water is all that remains of the great central sea which once extended from the Euxine (Black Sea) to the Polar Sea. As a result of this isolation, the Caspian loses more water through evaporation than its drainage basin supplies, and it is still falling. In 1890 it was more than 80 feet below the level of the Black Sea. At that time Elisee Reclus wrote: "If it were to rise to the original level, it would cover the surface of the steppes for several hundred thousand square miles and completely inundate the Volga River Valley below Saratov."

The Caspian is divided into three distinct parts which differ greatly from one another in depth and salinity. The northern section, a vast marsh, is nowhere more than 50 feet deep and has a salt content of 0.0016. There the Terek, the Ural and especially the Volga River discharge so much fresh water into it that the sea provides water for drinking purposes. The deeper central basin extends to a spur of the Caucasus, and in the southern end, which is mostly surrounded by high mountains, soundings of 2953 feet have been logged. In both these areas the average salinity is only 0.009, or one-half that of the Black Sea, which would seem to indicate a considerable decrease in the saltiness of the Caspian since its separation from that body of water. This is borne out by the shells of marine creatures found on the plains once covered by the Caspian and by shellfish of the same but smaller

An Amazing Tool

Compressed air continues to demonstrate that it is one of the engineer's most adaptable tools. Amazing tiny bubbles conquer fires in oil storage tanks, cushion rock-rupturing blasts, smash angry ocean waves, keep log ponds open in winter and protect dams and hydroelectric structures from crushing ice. Related to the last-mentioned uses is the proposal made here to utilize their water-lifting power to curb costly evaporation from reservoirs in arid regions. The author, a hydraulic engineer who has designed many dams, has long studied the pressing problem of water conservation.

PHOTO, A. DEVANEY, INC.

HOOVER DAM AND LAKE MEAD

Key structures in the water-distribution system of the Lower Colorado River basin, they make millions of acres habitable. In this area the annual loss through evaporation in the case of such a body of water has been computed to be 100 inches. This means that Lake Mead, with 120,000 acres of surface, loses one million acre-feet a year—enough to put 12 inches of water on a million acres of land. For all the reservoirs in the Southwest the loss is tremendous.

PHOTO, U. S. BUREAU OF RECLAMATION

WATER CARRIER TO THIRSTY LAND

Section of Soap Lake Siphon on the West Canal which distributes water stored behind Grand Coulee Dam in the State of Washington to 288,000 acres of naturally arid land in the Columbia River Basin. The pipe is 25 feet in diameter and could carry the entire domestic water supply of Canada, Argentina and Ecuador, assuming that each resident used 100 gallons daily.

species now inhabiting the latter, for the size of the shells is proportional to the salt content of the water.

This decrease in salinity is explained by the fact that water evaporates at a different rate at different temperatures. As along the Gulf Coast of Texas, the waves of the Caspian throw up banks of sand in front of shallow bays along its shores, thus converting gulfs and creeks into lagoons. Sea water enters the latter through narrow channels, and because the water is not deep it is considerably warmer than that in the open sea. Evaporation is consequently greater, and sea water flows in to restore hydrostatic equilibrium. The lagoons therefore become depositories of salt. When storms or dry periods cause them to be isolated, the water rapidly evaporates and leaves layers of salt in them.

Reservoirs of this kind may be studied all along the circumference of the Caspian. A former bay not far from Novo Petrosk is divided into a large number of basins, which present every degree of saline concentration. The same condition exists farther south near the Bay of Alexander and at the extreme end of the northern section in the sea arm of Karasu (black water). There the water is 0.057 part salt, exceeding in salinity the Gulf of Suez, the saltiest body of water.

On the east shore of the Caspian is the remarkable inland sea, rather than lagoon, called the Karaboghaz (black abyss). According to Reclus, a current from the open sea was always running into it through a narrow channel at a speed of 3 knots. The east winds retarded it and the west winds increased it, but it was never less than 1½ knots. Caspian seafarers and Turkoman nomads who inhabited its shores were impressed by the inexorable flow rolling over the shoals into the "black gulf," which none ventured to navigate because they believed it to be an abyss into the underworld.

Baer estimated that the Karaboghaz receives daily 350,000 tons of salt from the Caspian. Seals are no longer found there. A sounding line, when scarcely out of the water, is covered with saline crystals. Thus Nature demonstrates that evaporation from cool water is less than from warm, and that water should be cooled to reduce evaporation. The next step is to find a cold medium that will serve to cool the surface waters. Actually, the reservoirs themselves can provide it, for they are virtually unused iceboxes.

The greater part of the Southwest has severe winters and hot summers. In the winter months the icy waters sink to the bottom; in the summertime warm water floats on top of the lower, colder layers. The density of the warmer water is from one to three thousandths less than the density of the colder strata. This is characteristic of all lakes in temperate regions and produces the familiar phenomenon of annual "turnover" in spring and fall. The deeper, colder layers demonstrate their presence in many ways. For instance, on the bathing beaches of Lake Michigan a rising east wind blows the water westward. When that happens, warning signs are posted and the upwelling icy water immediately causes the beaches to be deserted.

Unequal temperatures and densities bring about so-called density currents. The Office of River Control of the Bureau of Reclamation publishes annual reports containing graphs of the tempera-

PHOTO, EWING GALLOWAY

FISHING BOAT ON CASPIAN SEA

Although still sizable (730 miles long and 260 miles wide), the Caspian once extended from the Black Sea to the Polar Sea. It loses more water through evaporation than it receives from its drainage area and is therefore still shrinking.

ture, density and other factors in relation to the depth of Lake Mead. From these the following example is taken. On April 17, 1950, at Mile 334.9, where the water is approximately 400 feet deep, the temperature at the surface was 64°F; 150 feet down it was 54°. Six months later the temperatures at the same levels were 84° and 58°, respectively.

Studies at Lake Hefner, Oklahoma, have produced what is known as the Hefner formula. Applying this to certain average conditions it is found that evaporation would be:

0.057 inch per day at 55°
0.276 inch per day at 67°
0.415 inch per day at 80°

From this it may be seen that a drop of 13° reduces evaporation to two-thirds of the value at 80°.

Compressed air has long been used successfully to bring warm water from the bottom to the top for varying purposes even when the difference in temperature was small. To keep trash racks of hydroelectric stations ice-free, for example, air under pressure has been introduced through perforated pipes at the bottoms of intakes to make warmer water rise and thus prevent the formation of ice at the surface. This has been possible even in the case of shallow intakes. Similarly, air released from pipes lowered through holes cut in ice near frozen spillway gates effectually clears away the obstruction in one day's time. This procedure is followed by waterpower plants on the Ausable River in Michigan where the winters are severe. In much the same way sawmills in the North Country keep channels open in their millponds so logs can be floated to the mills the year round.

To reduce loss of water through evaporation, this procedure might be used in reverse. The Lake Hefner experiments revealed that during a 483-day period condensation rather than evaporation occurred on 56 days. The large unused volume of cold water in the lower levels of the Hoover Dam basin could be raised at least in part by means of compressed air and mixed with the surface water to lower the temperature and thereby lessen evaporation. To apply this method to a reservoir like Lake Mead would be a big job, but preliminary analyses of the complicated problems involved seem to indicate that it is feasible.

The author has conducted experiments in Texas and made many calculations as to what could be done by the use of specially equipped motorboats—floating versions of truck-mounted compressors. These could cruise around in the early morning when the water is coolest at the surface and could cover a great area in a short time. Considering that little power is required merely to circulate, not lift, the water in a lake (the difference in density is only 1/1000 part or so), the idea is not nearly so impracticable as it might appear at first hand.

Large losses demand extensive corrective measures—a routine matter in this day of huge projects. Research is needed, of course, to gather exact data. There is no difficulty involved in making measurements of evaporation by means of pans floating on the surface in areas where a compressed-air line has been lowered, and the comparative efficiency of stationary and mobile installations could easily be studied. The experiments would cost relatively little and should be undertaken because the time is not far off when the West, especially, will have to conserve every acre-foot of water if it is to remain productive. The iceboxes are there. Why not make use of them through the simple medium of bubbles of air?

PHOTOS, A. DEVANEY, INC.

PLEASURE BOATS ON LAKE MEAD

In addition to the benefits it bestows through irrigation and power, Hoover Dam has created a much appreciated marine playground and recreation center in the midst of a desert atmosphere.

NO ROAD NEEDED

Experimental Teracruzer negotiating rough ground. The arrangement of two air bags to a framework is in plain view. Air hoses are shown running to the near ends of the bags. Two of the cylinders for tilting the frameworks to raise or lower the forward pair of bags are visible. The forward-slanting windshield and depth of cab are evident.

Air-bag Wheels Smooth Out Bumps

Huge Land Cruiser "Floats" Over Roughest Terrain

A VEHICLE without springs that can travel smoothly over any kind of terrain with a load of from 7 to 10 tons has been developed for the U.S. Army Transportation Corps by the Four Wheel Drive Auto Company, of Clintonville, Wis. Its "wheels" are eight large watermelon-shaped air pillows that yield to surface irregularities instead of resisting them. Called the Teracruzer and intended to carry cargo and personnel, it is 25 feet long, 12 feet wide, 10 feet high and weighs 20 tons. An experimental model is now being tested.

The soft, fat, low-pressure tire bags are each 5 feet long and 42 inches in diameter. Inflated at a pressure of only 3 to 5 psi, they conform to humps or rocks in their path, "swallowing" them instead of bouncing off as do conventional automobile tires charged with air at pressures above 20 psi. Their large bearing surfaces give them good traction on varying surfaces and permit the vehicle to ride safely and comfortably over ground that is rough and rocky or soft and unstable —through sand, swamp, snow or ice— up steep inclines and along hillsides.

The Teracruzer's cab is 9 feet 8 inches wide, 8 feet long and 5 feet high. It provides room for two men to sleep while two others, a driver and an observation-navigator, operate the vehicle. For the convenience of the observer there is a plastic bubble dome in the roof. In addition, the cab houses the carrier's 340-hp Continental engine in a pressurized compartment accessible for repairs. If the engine has to be changed, it can be disconnected and lifted through the cab roof.

The cab section is winterized for sub-zero temperatures. It is insulated throughout and has a 60,000 Btu heater to warm the 24-volt batteries and engine as well as to keep the crew comfortable. A windshield that slopes forward at an 18° angle reduces sun glare, prevents precipitation from piling up on or sticking to the glass and permits clear vision of the terrain immediately ahead. Just behind the cab is an aluminum 250-gallon tank for the engine's gasoline fuel supply.

A central inflation system enables the driver while underway to increase or reduce the air pressure in the individual bags. The latter are attached to the chassis by an arrangement known as controlled walking beams. These allow the operator to distribute the load uniformly on each pair of bags when traveling on compact terrain. The walking-beam design also permits tilting the front bags upward to throw the weight of the vehicle on the rear bag of each pair when going over snow or soft ground, the front bag then acting as a compactor.

The bags were developed by Goodyear Tire & Rubber Company from the Rolligon principle invented by William H. Albee and are made of 4-ply nylon with chevron-patterned lugs ½ inch high. Although the bags are held in position by eight individual axles, they are driven by rotating rubber-coated tubular steel rollers that come in direct contact with their top surfaces. Each bag is propelled by six rollers, the surfaces of which are machined in a pattern that matches the Rolligon lugs, providing rubber gear action between rollers and bag instead of simple friction contact. Engine power is transmitted to all the rollers by means of four main drive shafts, each operating a set of 24 driver and idler gears to propel twelve rollers, and thus two bags.

The bags are cradled in pairs on four identical frameworks, two side by side in front and a similar arrangement in the rear. The two front frames are united by a superframe, which pivots on a turntable under the main chassis and insures

unified steering of all four front bags. The two rear frameworks, controlling the other four bags, are affixed to the main chassis in stationary position.

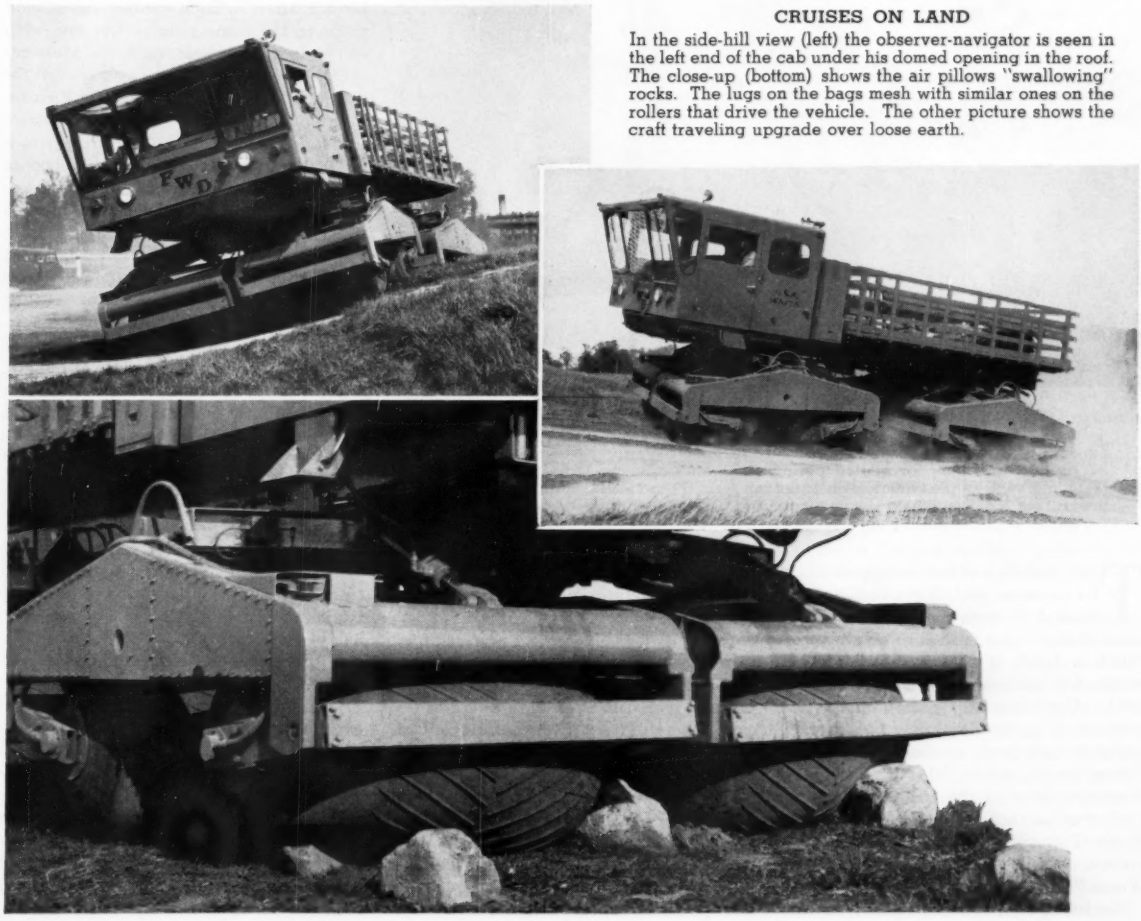
Air for inflation is conveyed by permanently attached lines from a 12-cfm compressor to rotating seal valves developed by FWD for the purpose and attached at the outer ends of the bags. The pressure in each bag is shown on a gauge in the cab and may be adjusted by moving individual air-valve handles. There are also four sets of indicators and control valves that permit of minute regulation of load distribution on each pair of bags. They enable the driver to tilt the framework, cradling each pair of bags up to 10° forward or backward to effect the walking-beam action. Hydraulic steering is controlled by a curved-hoop tiller bar rather than a wheel and gives the vehicle a 50-foot turning radius.

The propulsion engine, designed by Continental for Army use in tanks, heavy carriers and heavy trucks, is an 8-cylinder, pressure air-cooled unit that is making its first appearance in the Teracruzer. The latter has an Allison torque converter and automatic transmission, a 6-speed combination that also was developed especially for the Ordnance Corps but until now was never installed in any vehicle. Though the Teracruzer normally travels at fairly low speeds because of the rugged terrain it is required to negotiate it can cover around 25 miles per hour over generally level surfaces.

The body of the present experimental unit is of wooden stake design, 10 feet 4 inches wide and 14 feet 10 inches long. It includes a 2-foot front section for carrying two spare Rolligon bag assemblies, repair kits and tools. Fold-down seats along the sides accommodate personnel. Virtually any type of body can be adapted to the chassis. In addition to military use, the Teracruzer can perhaps be made to serve different commercial purposes by giving it a materials handling or dump body or a fifth-wheel mounting for a semitrailer. Field exploration parties such as petroleum-industry geological crews might be able to use a modified type in rough or marshy regions.

Smaller vehicles mounted on the Rolligon air bags have been tried out previously by our Armed Forces and were written up in the *Saturday Evening Post* of June 4, 1955. According to that article, our Government has spent in excess of $1,000,000 in testing them in an effort to find the best means of transporting fighting men in roadless wilderness areas. The same account mentions that Army Engineers have hauled heavy bridge sections with them and that they have plans drawn for strings of cargo carriers that will move on bags up to 12 feet high and individually capable of supporting a 30-ton load when inflated at only 5 psi pressure.

The inventor of the pneumatic Rolligon got the idea for it from some Eskimos in 1935 while he and his wife were teachers in a settlement near Bering Strait. One day he saw natives, just returned from a walrus hunt, exert lung power to blow up some tightly sewed sealskins and use them as rollers on which to move a 5-ton boatload of meat up a steeply sloping beach composed of loose gravel and rocks. Years later, during the Korean engagement, he experimented with the bag-wheel scheme as a possible means of facilitating Army transport and finally enlisted the aid of the Goodyear organization. He built the first vehicles utilizing the principle virtually with his own hands.



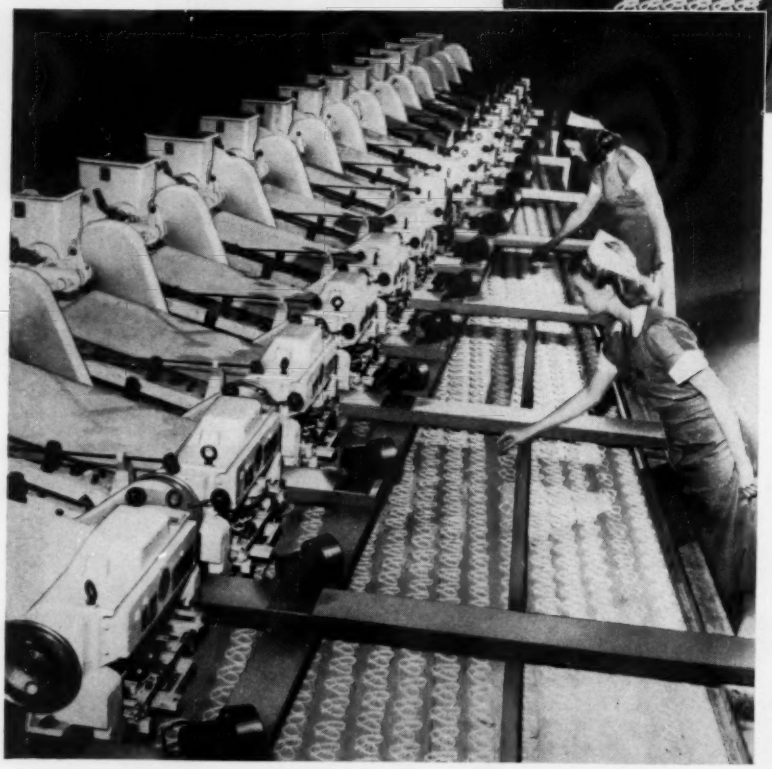
CRUISES ON LAND

In the side-hill view (left) the observer-navigator is seen in the left end of the cab under his domed opening in the roof. The close-up (bottom) shows the air pillows "swallowing" rocks. The lugs on the bags mesh with similar ones on the rollers that drive the vehicle. The other picture shows the craft traveling upgrade over loose earth.

Pretzel Twisting Goes Mechanical

Popular Pennsylvania Dutch tidbit succumbs to modern influence

Jane S. Muller



HAND VS MACHINE

Expert hand twisters (top) are still at work in some bakeries. They can turn out 32 pretzels a minute for limited periods but won't average more than twenty. Machines such as the bank shown at the left form 50 or more a minute and never tire or take a coffee break. Each accounts for one row of pretzels on the belt.

THE inability of bakers appreciably to increase pretzel production has denied to many people the salty taste of that crisp morsel of goodness of which a total of 100 million pounds, worth $30 million retail, was baked in 1951. Until recently pretty much the product of man's dexterity, the pretzel business has been confined mostly to Pennsylvania, where 53 of the 68 bakeries operating in the United States in 1952 were located. Reading, in the heart of the Pennsylvania Dutch country, is known as the "Pretzel Capital of the World."

Centuries ago, so legend has it, monks in southern Europe gave pretzels or *pretiola* to small children as a reward if they learned their prayers well. Made by the holy men themselves, they were shaped to represent a child at prayer with arms folded across the chest. Before long, pretzels began to appear in bakeries because the children, after leaving school, created a demand for them. In fact, the pretzel became so popular that it was one of the symbols which appeared on a crest ordered by an emperor of Austria to commemorate the bravery of the Bakers Guild in battle. It became the baker's banner and still marks his trade in Europe three centuries later.

At some time pretzels are supposed to have been baked in the form of rings large enough to be worn about the neck before eating in order to keep away evil spirits. Another belief was that hanging them on fruit trees would increase their crops. And for hundreds of years in European countries a pretzel has been treated like a wishbone. Pulling the biscuit apart with a companion is said to have the same result—the one with the biggest piece gets his wish. More recently, its traditional use as a reward for good behavior was revived in Easton, Pa., when policemen passed out pretzels on Hallowe'en. They began the custom in 1949, and records show that bluecoats in prowl cars distributed 25,000 of the goodies to more than 8000 youngsters in 1950.

The art of pretzel making was brought to America by emigrants who settled in the Pennsylvania Dutch country. For many years they were baked over open-hearth fires in home kitchens, but after a time they became a side line of bakers, and the pretzel vendor became a familiar figure in many communities. The first commercial pretzel bakery in the United States was opened near Lititz, Pa., in 1861 by Julius Sturgis who, as an apprentice to Ambrose Rauch, was able to procure a recipe for hard pretzels reputedly given to Rauch by a tramp in return for some food. Pretzel bakers handed down the jealously guarded secrets of their trade just as did other craftsmen—the list of ingredients and techniques were carefully withheld from competitors and laymen alike.

For many years pretzel baking, because of the very nature of the product, resisted the advances of science. Until three years ago the original Sturgis bakery was still operating in almost the same manner as it did when it was founded. Then John Hubley, the present owner, found it necessary to replace the coal-fired wall ovens with an oil-fired rotary oven to increase production.

Mechanical means have been employed for several decades in handling and packaging pretzels, but only recently have the bakeries gone so far as to substitute machinery for the old-fashioned pretzel twister who was a respected, well-paid craftsman in his community. The amazing robot is taking the romance out of the business, but is making it possible to increase output and thereby markets.

As early as 1879 two Lancaster, Pa., men claimed to have invented apparatus that would form 60 to 100 pretzels a minute. However, the device was not successful, and more than 50 years elapsed before a pretzel-twisting machine was developed by one of Reading's largest bakeries. At about the same time a Cleveland, Ohio, man, sponsored by the owner of a bakery in Canton in the same state, devised similar equipment. A decade or so later, American Machine & Foundry Company acquired rights to the Ohio man's invention. Refinements made by this firm resulted in a simplified and practical mechanism capable of turning out 55 twisted pretzels a minute, as against a maximum of 20 shaped in the same interval by trained human hands.

Usually installed in multiples of fourteen or sixteen, the units are staggered along a wide conveyor belt the speed of which is determined by the length of the oven. A batch of dough, generally weighing 15 pounds, is placed in the hopper of each machine and yields approximately 1125 pretzels. The dough is extruded through an opening at the bottom of the hopper, where a revolving knife cuts off a lump. This falls between two rolling belts which form it into a stick that drops into a trough-like receiver at the front of the machine. There it is gripped by fingers which, in one rapid motion, tie the dough into the familiar shape around stainless-steel wheels where a mechanical thumb presses the ends against the soft body.

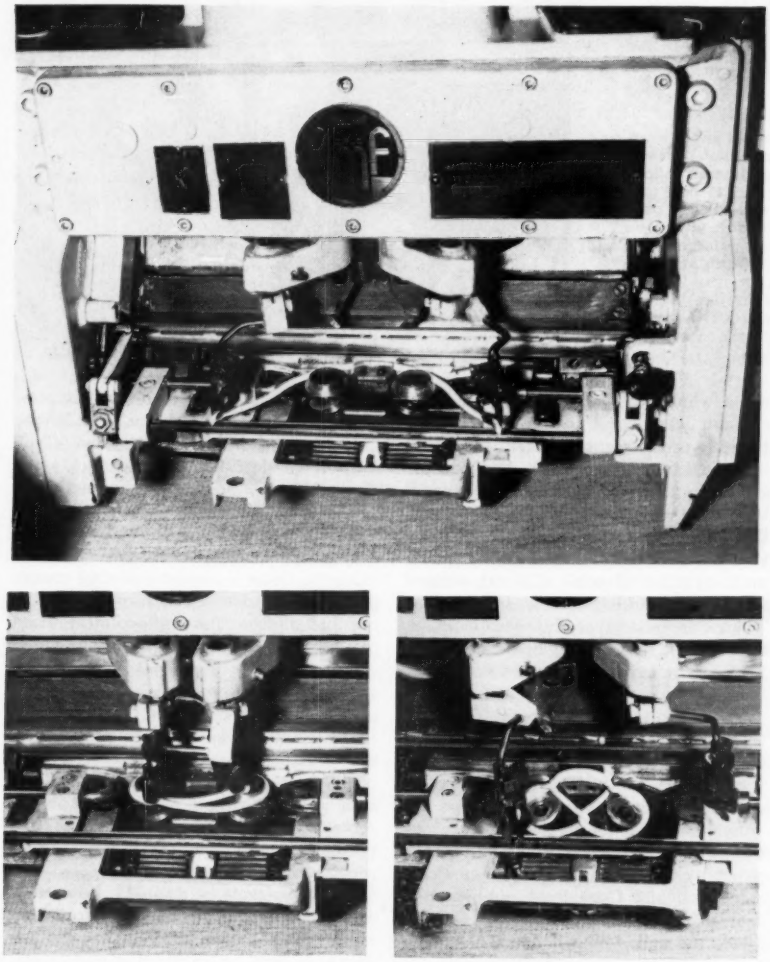
Next, the raw pretzels drop onto a conveyor belt and are transferred to a bath containing a boiling saline solution that seals the dough and assures the desired nut-brown color. Upon emerging from the bath the pretzels are showered with rock salt from an overhead hopper and baked in rotary ovens from which they go to drying chambers. The twisting machine may be adjusted to produce any one of a number of standard sizes ranging from 55 to 100 units per pound. Early in 1953 an improved type was patented by a Reading man for a bakery located in that city. It is said to turn out 120 a minute, thus doubling the maximum output of the earlier model.

Modern packaging methods virtually guarantee the arrival of pretzel products at their ultimate destinations as temptingly fresh and crisp as when they left the factory, but the variety of shapes in which they are now made has increased the handling problem. In addition to the conventional form there are sticks of different lengths and thicknesses, rings, figures, nuggets and rods, each of which requires a special container. Because pretzels are not free-flowing and because they are highly susceptible to breakage, most companies have found that packaging calls for skilled workers rather than machinery. However, automatic devices are used wherever possible to speed up the operation.

Keeping pretzel sticks in alignment after cutting and maintaining that alignment during carton filling involved difficulties which one manufacturer, American Cone & Pretzel Company, St. Louis, Mo., solved by developing and building timed filling equipment to operate in conjunction with a standard carton-forming machine. The latter converts hopper-fed blanks into trays and conveys them to the loading line traveling below automatic cut-off knives.

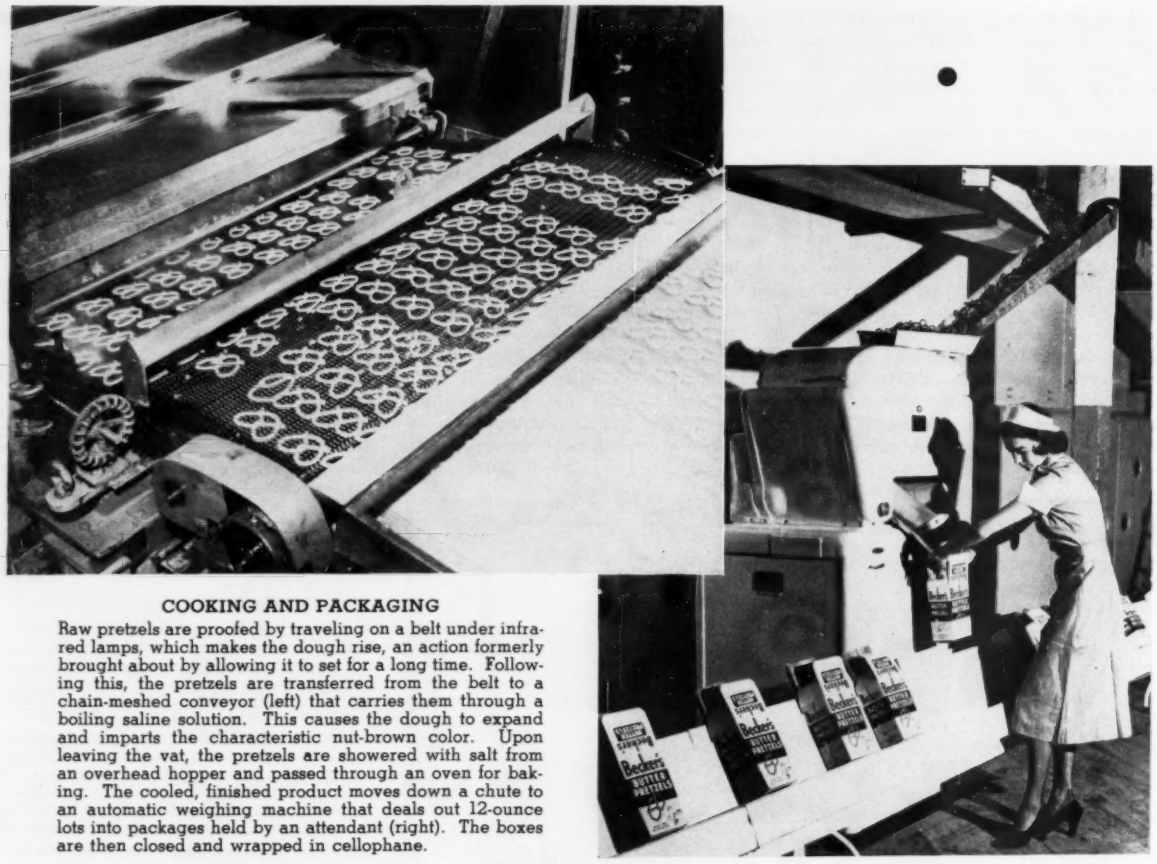
As the sticks are cut into the desired length, they slide down a slightly tipped corrugated channel into a series of V-shaped pockets which serve to keep them in alignment. Cutting and opening and closing of the pockets are synchronized and timed so that each tray, as it moves along on the vibrating belt, will receive the specified quantity from a number of the pockets. After passing through a drying oven, the trays go to two packaging lines where the inside dust flaps are folded over and creased and where the cartons are checked for weight. Finally they are wrapped for marketing.

In the case of twisted pretzels, American Cone & Pretzel Company is con-



ROBOT TIER

Dough fed into a machine is mixed and extruded in measured portions. Two belts, moving in opposite directions, roll each piece into a long, thin, round strip called a "snake." Gripper fingers (top) pick up the snake and wrap it around forming wheels. The ends are crossed and the familiar pretzel shape begins to take form (bottom-left). When the pretzel has been finished, the wheels turn 180 degrees and drop the product onto a lower plate (right) and thence onto a moving belt while the arms move back to pick up another snake.



COOKING AND PACKAGING

Raw pretzels are proofed by traveling on a belt under infrared lamps, which makes the dough rise, an action formerly brought about by allowing it to set for a long time. Following this, the pretzels are transferred from the belt to a chain-meshed conveyor (left) that carries them through a boiling saline solution. This causes the dough to expand and imparts the characteristic nut-brown color. Upon leaving the vat, the pretzels are showered with salt from an overhead hopper and passed through an oven for baking. The cooled, finished product moves down a chute to an automatic weighing machine that deals out 12-ounce lots into packages held by an attendant (right). The boxes are then closed and wrapped in cellophane.

vinced that they are best handled by skilled workers because that is the only way to insure minimum breakage and the right number in a bag. (A variation of but one in a small package may mean 20 percent over- or underweight.) Standing on both sides of a 30-foot-long table with pretzels and bags in front of them, the workers fill the latter and place them on a conveyor that carries them to a heat sealer, whence they go by chute to a packing station.

At a Baltimore plant, which uses American Machine & Foundry Company equipment, twisted pretzels are packaged mechanically, as an accompanying picture shows. From an overhead chamber, where they are dried after baking, they move down an inclined chute to an automatic weighing machine which deposits them in 12-ounce lots in boxes held, in turn, against the discharge end of the chute by the operator. The empty cartons are delivered by a slowly traveling conveyor, are filled at the rate of four per minute and returned to the belt by the worker. Boxes are then closed and wrapped in cellophane to keep them fresh.

Pretzels have a larger protein and carbohydrate content than any other baked goods, according to the National Pretzel Bakers Institute, which claims that they are a wholesome food because they are cooked, baked and toasted. They are the only product of the baker's art which is cooked, a process which develops the gluten in flour and increases the digestibility and nutritional value of the product. The solution in which members of the institute cook their pretzels leaves on them a light deposit of bicarbonate of soda, which adds to their digestibility. Their crispness gives the teeth exercise, and the salt helps to replace that lost by the body when it is exposed to excessive heat.

While pretzels are mostly eaten as they come from the bakery, they are used for cooking in the Pennsylvania Dutch region. Perhaps the best-known of these dishes is pretzel soup, the recipe for which varies from one locality to another. One of the simplest of these is given by Ruth Hutchison in her *Pennsylvania Dutch Cook Book* published by Harper & Brothers, New York City, in 1948, and calls for:

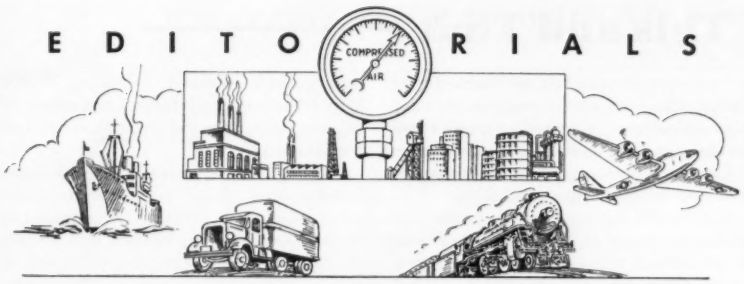
2 tablespoons butter
2 tablespoons flour
6 cups milk
1 dozen pretzels
2 tablespoons chopped parsley
Dash cayenne pepper

"Blend flour and butter. Add milk gradually, blend well and bring to a boil. Simmer 10 minutes, add parsley and pepper. Break pretzels into four large bowls, pour the soup over them at once. This soup is wonderful for a late snack after a large party and, by the same token, just as good for Sunday breakfast."

Some recipes which include pretzels may be but do not sound tempting. For example, there is one for a pretzel crumb pie which features a lemon-meringue filling and another for a chocolate-pretzel pie crust filled with vanilla or coffee ice cream topped, if desired, with fudge sauce. Less adventurous souls may try pretzel-cream cheese balls, cheese-dipped pretzels and pretzel bread and may even use pretzels, crushed and mixed with other ingredients, as poultry stuffing. But most consumers will content themselves serving them with beverages, appetizers, soups, seafood and with desserts, especially ice cream.

While pretzels made in Pennsylvania and surrounding states are shipped to most of the major cities in the United States as well as to Europe and South America, there are still many individuals to whom the product is unknown. At the present rate of production there are not enough to satisfy potential markets, a situation that is fast being remedied as the age-old industry becomes more and more mechanized.

EDITORIALS



BOGUS SPARE PARTS

ANY individual or firm that succeeds in improving an existing product will inevitably attract a following of counterfeiters. These concerns don't usually copy the entire product but, instead, offer unauthorized spare components or parts, almost always at a reduced price. Imitation may be the sincerest form of flattery, but in such cases it is not relished. Nor are the imitators rendering a service to consumers. In most instances they are merely trading on the dearly bought, hard-earned reputation of the legitimate manufacturer. They create nothing; they merely reproduce something for which there is a ready market and start up a bootleg business.

Sometimes the consequences can be tragic. Last summer a heavy milk truck careened down the main street of a mountain town in New York, killing three persons and injuring fourteen before coming to a stop. An examination revealed that the diaphragm in one of the air-brake cylinders had ruptured. It also disclosed that the diaphragm had not been made by the concern whose name was stamped on it. Somebody had counterfeited the trade mark of a reputable, responsible brake maker. The brake was spurious and it failed. The companion brake, on the opposite end of the axle, was genuine and had continued to function but could not hold the load by itself.

Many industries are similarly plagued by parts counterfeiters. Radio and television tubes and automobile ignition parts, especially, are the objects of the art of deception. Sometimes genuine parts that have been used and discarded are rehabilitated and sold for new. They fail early, and the original maker gets the blame.

Machinery builders have a lot of headaches because of these parasites. Rock-drill manufacturers have long had to contend with "bogus" parts vendors. These concerns do not make or sell complete machines and therefore assume little or no responsibility. They concentrate on the production of certain vital drill parts that must, inevitably, be replaced sooner or later because every new machine starts to pound itself to pieces as soon as it goes to work. Their investment is small, they take little risk and spend little to make sales. The demand for their products is created for them by others. Lacking a drill manufacturer's years of experience and research facilities, they can't duplicate the quality of the genuine parts but can undersell the established firms. They are the bargain basement of the industry, and everyone knows that so-called bargains are not always worth-while. The old maxim that you get about what you pay for still holds true.

A NAME IS CHANGED

AT THE last annual meeting of its stockholders, the Anaconda Copper Mining Company dropped the words "Copper Mining" from its name. This wasn't done because it has stopped mining copper. On the contrary, it is producing more of that metal than ever before. The reason was that Anaconda is no longer just a copper mining company, or even just a mining company. It produces, processes and fabricates a wide range of nonferrous metals.

There is nothing unusual or significant about a large industrial concern changing its name. Many firms do it, and some of them have done it several times. It is the way of the world to change, and corporations and people must change with it to keep abreast. Those that stand still are, relatively, going backwards. The interesting thing to note in connection with Anaconda's altered title is that there have been vast developments during its corporate life of only 60 years, and these have not only affected its activities but also virtually revolutionized our national economy, our ways of living and our future outlook.

As pointed out at the annual meeting by retiring board chairman Cornelius F. Kelley, the name that was adopted when the company was formed on June 18, 1895, was appropriate. Then, and for some years following, the firm was engaged solely in mining, milling and refining copper. Operations were started through one mine shaft at Butte, Mont., on what has since become "the richest hill on earth." The Electrical Age was at that time just dawning, and a big demand for copper was in prospect. Anaconda was a pioneer in introducing large-scale production means and methods to help meet the need as it materialized.

Mr. Kelley took a job with Anaconda less than ten years after its founding. Within the span of his working life, then, the Electrical Age has come into full bloom. It isn't fading yet, and we are already well along in the Electronic Age and on the threshold of the Atomic Age. At our present pace, ages are overlapping.

Meanwhile, that amazing hill in Butte has brought forth many surprises. At the outset it yielded gold and silver, but beneath the surficial deposits of these precious metals were masses of copper sulphide. But the Butte District is today far more than a copper producer. From it also comes 20 percent of the nation's zinc output, and the plants at Anaconda and Great Falls, Mont., that process and refine the zinc ore are the biggest of their kind. Moreover, the area accounts for 90 percent of our manganese, a metal that is vital to steel making and a real sinew of national security.

As Butte has changed so, too, has Anaconda. Butte is still the company's stronghold, though additional huge copper reserves have been acquired both in this country and South America. To stay in step with the forward-surging world it has progressively broadened its base of activities. Through two subsidiaries it has become the largest fabricator of copper products.

This expansion is helping to meet the nation's apparently insatiable appetite for copper, the consumption of which is double the prewar rate of fifteen years ago. Once used chiefly in the electrical industry, the metal now fills diversified needs. Copper and brass are essential to the construction of every home, factory and office building. It is a far cry from the era of brass buttons and copper kettles that launched our copper industry a century and a half ago.

Meanwhile, Anaconda's mine hunters have had an eye out for nonferrous metals that are not found in Butte. To improve its competitive position the firm has launched a sizable aluminum operation that yielded its first ingots at Columbia Falls, Mont., last month. And, looking farther ahead, it has also turned to the development and production of uranium. All this, to quote Mr. Kelley, "is indicative of our faith in the future."

In its 60 years of activity, Anaconda has produced 18 million tons of copper, 5 million tons of zinc, 2 million tons of lead, 732 million ounces of silver and 6 million ounces of gold. At the end of another 60 years it will no doubt be able to chalk up sizable quantities of aluminum, uranium and perhaps of some metals that are now unknown or receiving little attention.

The world has, indeed, been moving fast, and a lot of industrial concerns, Anaconda among them, are matching strides with it.

This and That

To Foil Mine Layers

Wooden ships are coming back—for certain purposes. In a minesweeper, iron and steel are apt to be unhealthy because they attract magnetic mines, so the U.S.S. *Cormorant*, one of the Navy's newest, uses ferrous metals sparingly. The 144-foot hull is built entirely of wood. Piping for bilge water, cold salt water and fresh water and for fire service, as well as speaking tubes are Goodrich Koroseal plastic. The pipe and fittings weigh about one-third as much as they would if made of steel. Diesel-oil collector tanks and water tanks, normally of metal, are constructed of the same resinous material in sheet form.

★ ★ ★

Second Creole Plant

Creole Petroleum Company has announced that it will build a second and larger plant on Lake Maracaibo, Venezuela, for the purpose of returning to the ground gas that is produced with oil from the Bolivar coastal field that underlies the lake. Like the first plant (described in our February 1955 issue), the new one will utilize centrifugal compressors driven by gas turbines to increase the pressure of the gas gathered from producing wells at around 25 psi to the injection pressure of approximately 1935 psi. The present facilities take in 154 million cubic feet of gas daily, use 17 million cubic feet of it for fuel in ten 6000-hp turbines and compress the remainder in ten turbocompressors arranged in series to give seven stages.

The second plant will probably have twelve gas turbine-compressor units, each of 6000 hp, and handle around 300 million cubic feet of gas daily. As the capacity of the initial installation is expected to rise to 175 million cubic feet a day, the new plant will increase the over-all capacity to 475 million cubic feet. The latter will be about 6 miles from the first one and will cost approximately $32 million, as against $24 million for the existing one.

★ ★ ★

Robots May Run Compressors

"There is no doubt that automatic control of main-line (gas) compressor stations will become a reality . . . . When is a difficult question." This is the conclusion reached by a writer in *Oil & Gas Journal*, leading trade publication in the petroleum industry.

Some comparatively small field stations that pump gas through gathering lines to main-line pumping plants already function unattended. Although no main-line station has yet reached that status, some automatic controls are used in practically all of them. Among these are devices that shut down compressors if there is too much deviation from certain normal operating conditions.

Automatic stations are probably well within the range of engineering skill and would serve a practicable purpose. Providing them with the necessary controls would increase the initial investment an estimated 30 percent but might cut the running cost by 18 to 25 percent.

The reason more has not been done along this line is probably management's unwillingness to entrust complete supervision of costly equipment to robots. However, the gradual and persistent increase in wages and in the price of gas and materials is believed to be bringing the automatic station closer. Management is beginning to ask for reductions in building and operating costs.

★ ★ ★

Vogt's Diamond Anniversary

Henry Vogt Machine Company, of Louisville, Ky., is observing its 75th anniversary. It was established in 1880 by a young machinist who gave it his name and directed its operations until his death of the age of 80 in 1936.

The founder started doing general machining and building boilers, tanks and stacks. The first two products named have remained prominent ever since. In 1885 was added the revolutionary Vogt adsorption refrigerating machine which made it possible to manufacture ice the year round. Previously it had been cut from lakes and streams in the wintertime and stored until needed.

The equipment, which included a compressor to put the refrigerant gas under pressure over and over during the repetitive cycle of the freezing process, wasn't popular with those who had been profiting by harvesting Nature's crop. They dubbed it "the work of the devil," and called its product "artificial" ice. Vogt's modern counterpart of the contrivance is a tube-ice machine that turns out sized pieces for quantity users. It has also made ice for cooling mass concrete in large dams.

When Mr. Vogt found it difficult to get sound cast valves and fittings for his refrigeration piping systems, he began to produce his own. Their principal parts were forged to give them maximum strength. From that beginning the concern has become the largest manufacturer of forged-steel valves and fittings. As automobiles created a market for gasoline, unwanted until then, refineries sprang up and Vogt's boilers, cracking stills, tanks and refrigeration units came into greater demand. During World War I the company turned out scores of marine boilers for the ships that bridged the Atlantic.

Through the decades, Vogt has registered several "firsts" as to size of equipment employed. When the adoption of higher pressures for boilers and vessels used in petroleum cracking processes in the 1920's called for units of stronger construction, the firm installed a riveter powerful enough to bind together steel plies up to 9 inches thick with pins having a maximum diameter of 2½ inches. In recent years modern welding equipment has been added to the fabrication facilities. In 1930 a record-size forging hammer capable of delivering blows of 12,000 tons pressure was obtained. It serves to forge billets weighing up to 2000 pounds each.

In World War II, Vogt was one of the few manufacturers that could furnish the hundreds of straight-tube, cross-drum boilers needed for Liberty and Victory ships. It also provided heat exchangers, towers and tanks for use in nitric-acid plants making TNT.

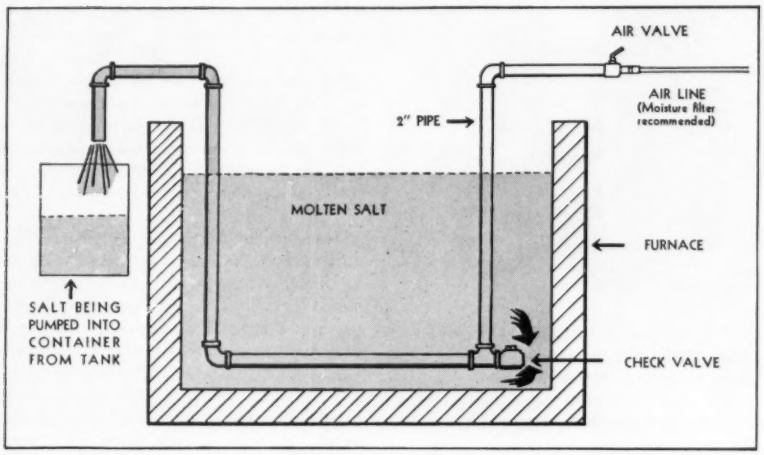
In 1937, when Louisville was paralyzed for several weeks by unprecedented flood conditions in the Ohio River, the Vogt plant was able to supply hospitals, bakeries and other essential establishments with electricity. During the Korean emergency it produced its regular line of equipment to the limit of its capacity and also turned out 105-mm shells. Later it manufactured quantities of valves for the Manhattan Project which developed the first atomic bombs. As most Vogt products can be used in nuclear-power plants, the concern anticipates a busy time during the Atomic Age. Two new shops were built recently, existing ones were retooled and a city block adjoining the plant was purchased for expansion.

★ ★ ★

Bosses Graded Monthly

The Buffalo, N.Y., plant of the Electro Refractories & Abrasives Corporation grades the work of its superintendents each month and issues report cards. If the card shows the recipient has been instrumental in cutting costs and increasing production of grinding wheels, crucibles and refractories, it may lead to a cash bonus. Each supervisor is allotted "premium units" according to his grade, and these may be worth up to $75 each in incentive payments, which are made at the end of the year. The plan, which is distinct from one in force for the plant's workers, was tried in the company's Canadian factory before it was put into effect in Buffalo.

Emptying Salt Bath with Air Under Pressure



IN MANY plants where metals are heat treated, emptying molten salt from pots is fairly easy because the receptacles are small and can be bailed out quickly. In other establishments such as aircraft factories, for instance, the work presents difficulties. There the bath must be big enough to accommodate large sections of sheet stock or structural frame members. Emptying it by bailing then becomes an arduous and time-consuming job that often calls for the services of every available man. By way of illustration, at the Garland, Tex., plant of Intercontinental Manufacturing Company, which makes aluminum subassemblies for planes, the average pot measures 15x2½ feet at the bottom, is 7 feet deep, and holds 30,187 pounds of salt. With one man on the job removing 20 pounds at a time he would have to dip his ladle 1509 times.

Although salt baths do not have to be emptied often—only occasionally for inspection and ultimately for replacement—a better method was plainly desirable, and Intercontinental has devised a simple one that relies on air pressure. The following description of it is digested from the *Houghton Line*, published by E.F. Houghton & Company manufacturer of Draw-Temp salt for heat-treating, and printed with its permission.

As shown in the accompanying sketch, the only materials needed are some lengths of 2-inch pipe, a few fittings and two valves. When the U-shaped assembly is submerged in the bath and the check valve is opened, air escapes and salt enters the piping, where it seeks its own level. The check valve is then closed and the valve in the air line at the upper right is opened. The supply is cut off after the air admitted has pushed the salt out of the pipe and into a receiver. By alternately opening and closing the two valves, the salt is pumped out, batch by batch. The salt in the container hardens, and when it is needed again it is broken into chunks of convenient size for handling and returned to the furnace for remelting.

At Intercontinental, air at 100 psi is used, but because the salt is heated sufficiently (800°F) to flow freely, less pressure is adequate and a reducing valve is provided. In plants where the salt is not so fluid air at 100 psi is required to prevent clogging of the piping. A moisture filter on the air line is a "must" to obviate the possibility of eruptive steam forming in the hot salt. Furthermore, it is recommended that the assembly be made of stainless steel for the sake of safety and to prolong the service life of the equipment, especially where the temperature of the salt is more than 800°F.

Compressed Air on a Mercy Mission

COMPRESSED air, which keeps divers and tunneling sandhogs alive while at their work, recently rescued hundreds of sheep from impending disaster brought about in an unusual manner.

Following a prolonged dry spell, windblown dust on farms near Eads, Colo., lodged in the thick, oily fleece of the sheep to such an extent that the animals were bogged down by the burden. Some of them were carrying as much as 25 to 30 pounds excess weight and could not shake off the dirt because it had matted into hard lumps. In this plight many of the animals had to be assisted to their feet repeatedly so that they could eat and drink.

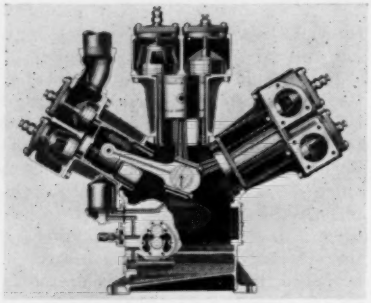
On the John Davis ranch alone, 1400 sheep were virtually helpless, and all available hands were kept busy getting food and water to them. After various possible methods of removing the dirt had been considered and rejected as ineffectual, Mr. Davis thought of using the same agency that was responsible for the situation; that is, blow the deposits off with air. A trial proved that the idea was workable, and facilities were set up to apply it on a production-line basis.

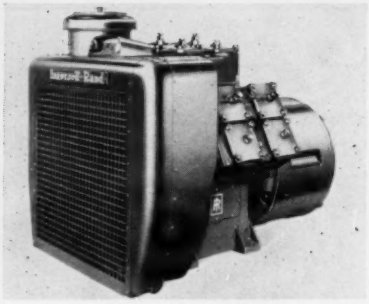
As the animals passed through a chute, they were gone over with a nozzle on the end of an air line and emerged lighter, cleaner and again able to shift for themselves. The pressure of the air coming from a compressor was reduced to a point where it would not hurt the sheep but still be adequate to do the job. A period of ten days was required to go over the flock.

SAVING THE SHEEP

Hubert Davis stirs up a cloud of dust as he passes the nozzle discharging low-pressure air over one of the sheep in a chute.

Industrial Notes





For permanent or temporary jobs where the use of a heavy-duty air compressor is desirable, Ingersoll-Rand Company has added a 125-hp unit to its line of Type 40 Motorcompressors heretofore available in sizes ranging from 25 to 100 hp. A packaged machine complete with electric motor, it requires a minimum of foundation space and is ready for service when power-line and discharge-pipe connections have been made. Among the new features of this 2-stage, air-cooled machine are a single-core, cross-flow intercooler with a large number of high-capacity tubes; precision-type crankshaft bearings which never need adjustment; force-feed lubrication with all oil passages drilled in the frame, crankshaft and connecting rods; and full free-air unloading. The latest Type 40 is available either with constant-speed control or with dual control which makes it possible to select constant-speed or automatic start-and-stop operation, whichever is most economical and best serves the purpose.

Circle 1E on reply card

A new rail clamp that weighs a little more than a pound and can be fastened to the base of any rail up to 100 pounds has been announced by Ohio Brass Company. It will take cables from No. 14 to 2/0 in size and is held in place by a cup-pointed setscrew that is provided with a permanent swivel-action handle and that bites through rust and scale to insure positive electrical contact. The body of the clamp is made of malleable iron and the cable connection and handle are fashioned of aluminum bronze. It is said that the clamp will carry 400 amperes continuously without overheating and that, because of its compactness, it will not interfere with the passage of car wheels.

Circle 2E on reply card

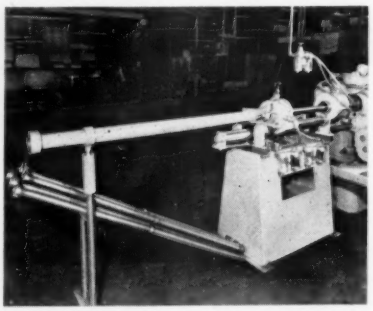
The mathematician has come to the aid of shipping departments by providing them with a cushioning nomograph that enables them to pack merchandise so that it will reach its destination in perfect condition. The data sheet, with instructions how to use, was computed by Container Laboratories, Inc., for the Celotex Corporation and applies, of course, to the latter's lightweight cane-fiber insulation board which is said to be strong, resilient, tough and low in moisture content. With a knowledge of certain variables—weight, fragility and bearing area, as well as height of drop expected in normal handling—the nomogram will tell a packer what thickness of cushioning material should be used for a specific product.

Circle 3E on reply card

Numerous advantages are claimed for a new nonslip flooring material for industrial use. It is a surfacing compound called Lacticrete and is part liquid rubber and part cement powder. They are supplied separately by the Naugatuck Chemical Division of U.S. Rubber Company and are mixed on the job and applied by conventional masonry equipment. A coat ¼ inch thick on a hard base such as concrete or metal is said to give the floor "bounce" so that it will not crack under heavy loads. The material is resistant to alkalies and mild acids and can also be used to patch worn spots, to waterproof the inner walls of storage tanks and as a cushioning pad under machinery.

Circle 4E on reply card

Machining operations on bar, hex or tubing stock can be performed more expeditiously, it is claimed, by a new air-feed and collet-operating unit developed by Erickson Tool Company. It consists of three main assemblies: a stock tube and filler tubes, a pneumatic feed chuck and a heavy-duty air cylinder of "donut" design. The workpiece is inserted in a

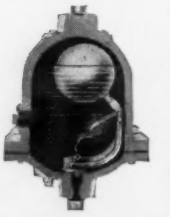


filler tube, which is supported throughout its length by ball bearings in the stock tube and turns with the stock to prevent marring it. The work itself is supported by the stock tube, the chuck and the cylinder. Both of the latter rotate to eliminate chatter, prevent whip and increase machining accuracy. One valve controls the operating cycle. When actuated, the collet is opened by the pneumatic cylinder, the chuck feeds the stock any preset length under air pressure and the chuck jaws open. Another flick of the valve handle closes the collet and returns the chuck to the starting posi-

ARMSTRONG *Snap-Action* AIR TRAPS
Assure Wide Open—Tight Shut Operation

Positive action, no dribbling, no hunting, no air loss—these are the advantages of the Armstrong "snap-action" ball float trap with spring-powered valve. The trap opens wide with a snap. *Before* all water leaves trap, valve snaps tightly closed. The valve is always water-sealed, preventing air loss. Fine dirt and grit won't interfere with operation.

TRAP CLOSED



The flat strip spring of special Swedish steel lasts for years in ordinary service. Valve and seat are hardened chrome steel. All other internal parts are stainless steel.

TRAP OPEN

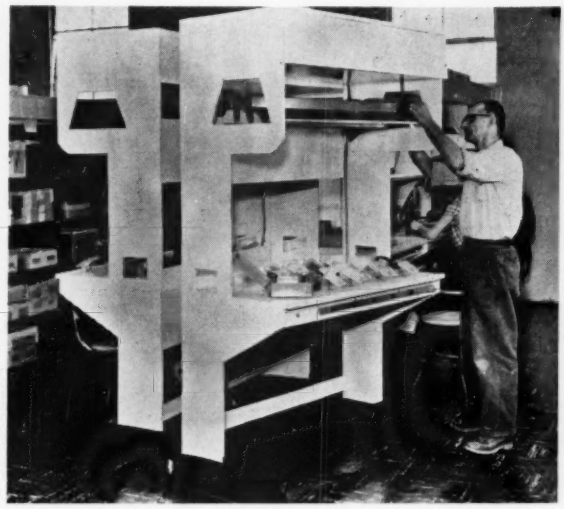
Where heavy oil is encountered in lines, use inverted bucket traps. Ask for Bulletin 2022, describing both types. Call your local Armstrong Representative, or write

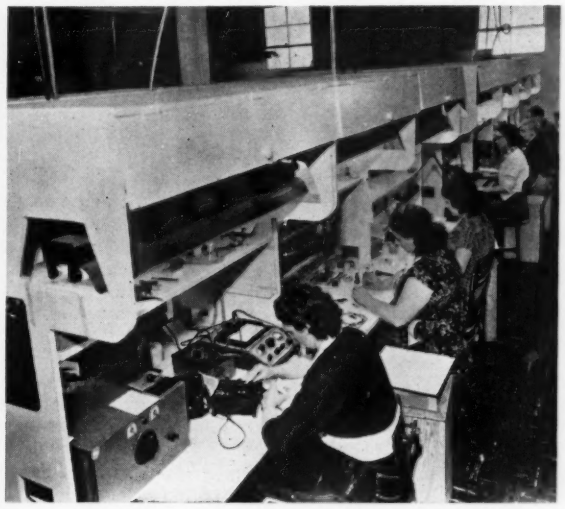
No. 71-315 is a forged steel trap having the same mechanism as the No. 71, but is designed for pressures up to 1000 psi.

ARMSTRONG MACHINE WORKS
885 Maple St., Three Rivers, Mich.

ARMSTRONG *Snap-Action* AIR TRAPS

Circle 17A on reply card





SECTIONAL WORKBENCHES

Like some bookcases that can be added to as a library grows, so can the assembly line pictured here be lengthened by annexing more worktables. The bench was designed for its own use by Assembly Products Inc., of Chesterland, Ohio, manufacturer of meters, relays and automatic controls and is constructed of plywood with a Novaply table top. Each is 52 inches wide over-all and has a commodious shelf, built-in lamp, and all necessary operational facilities. To conserve space, the units are set back to back, and each group of four is served by an electric and an air line with connections providing for a drop about every 4 feet. They can be easily rearranged, moved from one location to another and modified to meet different working conditions. Operator comfort was considered in designing them.

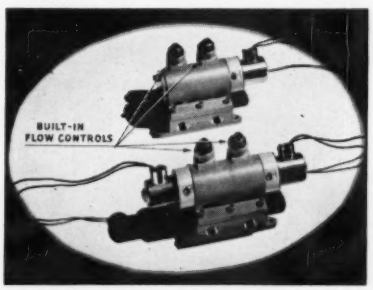
tion, where its jaws also close on the workpiece to give it a double grip. The length of feed is adjustable from 0 to 15 inches and stock up to 2⅝ inches in diameter can be handled.

Circle 5E on reply card

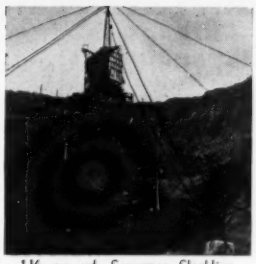
To cut the cost of maintaining industrial air-conditioning systems, or for comfort cooling where the cost of such installations would be prohibitive, there is now available a rotary roof cooler that operates on the evaporative principle. The device revolves slowly through gearing and is said to apply the water in thin sprays without the formation of pools or an insulating blanket of mist. Designated as the Ruppright Roof Cooler, each unit covers an area of 40x40 feet.

Circle 6E on reply card

For applications involving continuous operation and compact piping, Airmatic Valve, Inc., recommends its series of base-mounted single- and double-solenoid, pilot-actuated air-control valves designed to meet J.I.C. standards. Completely sealed to keep out foreign matter, both have built-in flow controls and only two internal moving parts: a single balance spool-type stem that rides on aircraft-type packing and the pilot plunger with molded-in seats. (The double-solenoid Model SS has two plungers.) The SS is a momentary contact valve and can be energized through a microswitch or relay; the single-sole-



You dig Pay Dirt with SAUERMAN MACHINES



1½ cu. yd. Sauerman Slackline digs 100 tph. of soft lead ore.

because

2 cu. yd. Sauerman Scraper reclaims 90 tph. from zinc mine chat pile.

sand, gravel, ore or other bulk materials become pay dirt when the cost of handling is only a few cents per cubic yard. It takes only one man to operate a Sauerman Scraper or Slackline Cableway—reaching out 1,000 feet or more to dig, haul and dump—across pit, pond, river or stockpile, or up to the top of a hill.

Sauerman can help you select the method of materials handling most profitable for your job—a system that will give you the **lowest** cost per cu. yd. handled.

Contact Sauerman for specific recommendations and information. Write for Catalogs and Field Reports showing your material being handled by the **low cost** Sauerman Method.

SAUERMAN BROS. INC.

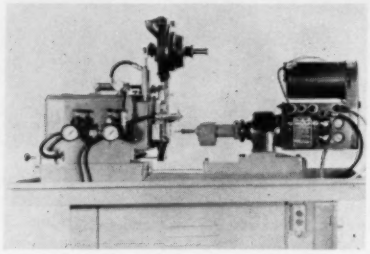
648 S. 28th AVE. BELLWOOD, ILL.

Circle 18A on reply card

noid unit has a spring return for electrical control, and contact must be maintained for the duration of the cycle. Valves for a-c and d-c voltages are available in sizes ranging from ¼ through ¾ inch. They are designed for pressures from 20 to 150 psi (double solenoid) and 35 to 150 psi (single solenoid).

Circle 7E on reply card

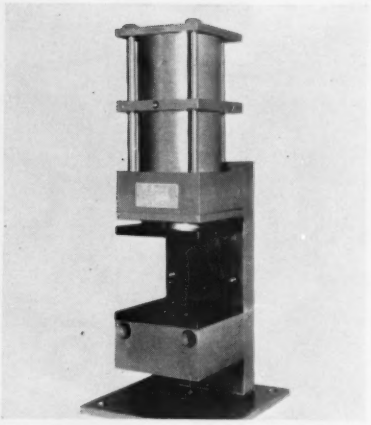
Batchelder Engineering Co., Inc., has announced a new automatic machine for tapping or drilling that features a number of coolant tanks in its base. Each contains a different cutting fluid, thus



obviating the need of removing unused coolant when changing over from tapping to drilling, or vice versa. It takes less than two minutes to switch from one to the other and about ten minutes from one operation to the other. The Model No. 410 is powered by compressed air at a minimum line pressure of 50 psi and at a rate of 500 strokes per cubic foot of free air. Cycling is regulated by 3-way solenoid valves. It is claimed that the machine accurately locates and securely holds rivets or other headed parts for axial tapping, or drilling close to very thin walls, without out-of-round distortion and central with the axis of the work. If a part is not properly positioned or the feed hopper is empty, the unit shuts itself off. It is suitable for hollow milling, centering, step drilling, countersinking, spot facing, reaming and certain combinations of these operations.

Circle 8E on reply card

Ruggedness is one of the characteristics of a new air press designed by Van Products Company, 5729 Old Ridge Road, Swanville, Erie 7, Pa., for use with die sets; for light bending, forming and forging; and for punching, swaging, crimping, wire splicing, etc. Of the Vi-Speed line and known as Series P66, the unit has a 6x6-inch platen guided by a 5-inch piston rod and powered by a 5-inch cylinder with a 3- or 6-inch stroke. There are four standard models with a vertical adjustable clearance of 8 inches, with cylinders providing a thrust of 1900 or 3800 pounds using air at 100 psig (working pressure ranges from 15 to 150 psi) and with an air return where heavy fixtures are to be attached to the moving platen. By removing the base plate the



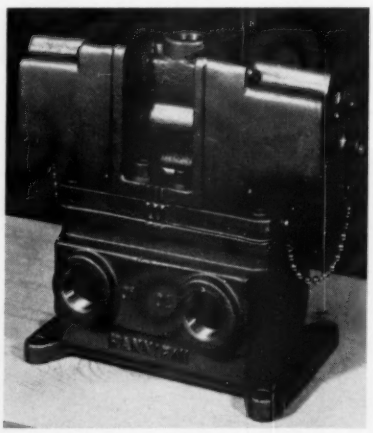
press may be mounted horizontally for operations such as drilling, tapping, and milling on a production basis. Any plant in the United States may obtain one of these units for an inspection and trial period of 30 days without obligation.

Circle 9E on reply card

One of those simple, useful items that comes to mind occasionally has been developed by American Cyanamid Company. It's a paper sling with tubes at each side into which the forks of a lift truck are inserted when picking up a load piled on top of the pallet for storage or shipment. Named Accopak, it is made of wet-strength paper, also a Cyanamid product, and weighs only 3 pounds.

Circle 10E on reply card

Air-cylinder control valves of a type that will be electrically inoperative should the solenoid covers be removed have been recommended by the Joint Industrial Conference. Accordingly, Hannifin Corporation has designed solenoid heads for its 3- and 4-way Pilot-Master valves that are said to meet that requirement and to be splashproof and dust-tight as well. Each cover is gasketed, is held in place by four captive screws, is chained to the valve and has a recessed "O" ring-sealed button that



NON-FLUID OIL

TRADE MARK REGISTERED

CUTS PNEUMATIC TOOL MAINTENANCE COST!

New "NR" grades of NON-FLUID OIL, made specifically for Pneumatic equipment and used and approved by most leading manufacturers of air tools—reduce over-all maintenance costs up to 50%. Reasons:

1. Provides rust-proofing even during indefinite down-time.
2. Eliminates gumming and sticking of moving parts, including fibre blades of rotary tools.
3. Higher lubricity with anti-wear agent reduces friction and increases speeds up to 30%.
4. Higher tool speeds mean more production.
5. Winter grade available with pour point of –30°F.

To test is to prove. Send now for Bulletin 550 and free testing sample of "NR" grade NON-FLUID OIL.

NEW YORK & NEW JERSEY LUBRICANT COMPANY

292 Madison Ave., New York 17, N.Y. - Works: Newark, N.J.

WAREHOUSES AND REPRESENTATIVES IN PRINCIPAL INDUSTRIAL CENTERS

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 19A on reply card

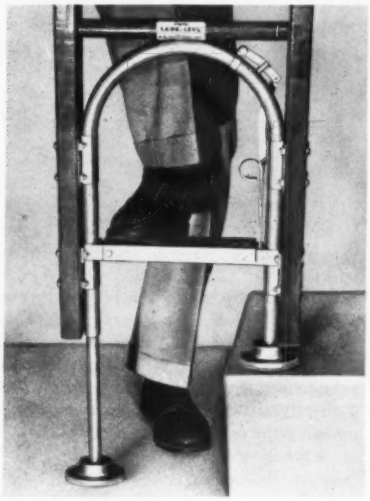
permits manual operation of the valve without removing the head. Both single- and double-solenoid P-M valves with the new safety feature are available in all standard sizes from ⅜ inch to 1¼ inches. Covers for valves of this type now in use may be obtained separately.

Circle 11E on reply card

Shops using soft hammers of lead, white metal or babbitt can now cast their own and recast them when worn in a mold manufactured by General Scientific Equipment Company. The mold is furnished complete with a reusable metal handle and can be obtained on trial.

Circle 12E on reply card

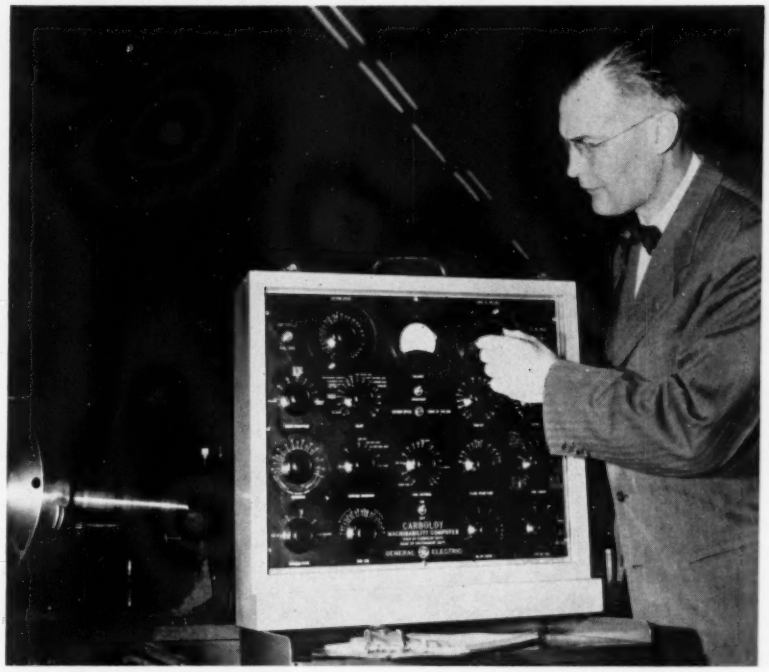
To help make the use of ladders safer, H-B Industries, Inc., is offering a device with self-adjusting legs that, as the accompanying illustration shows, adapt themselves to any floor level no matter how uneven. Called Ladr-Levl, it can



be attached to wood or metal and transferred from one ladder to another. When weight is put on the first rung, the mechanism locks automatically and remains locked until released by hand. Slipping is prevented by nonskid swiveling feet. The device is made of a special aluminum alloy and weighs 5 pounds.

Circle 13E on reply card

Machining problems that normally take tool engineers several hours to solve are answered with consistent and reasonable accuracy in less than two minutes by an electronic machinability computer, is the report of General Electric Company's Carboloy Department. We are told that the new tool will enable a methods and service man to determine whether or not he is using a correct set of conditions for machining a job in hand; will help him arrive at a proper set of conditions for another operation; or will indicate to him the results that



may be obtained (possibly increased production) by changing some of the conditions under which the work is being done. Described as a self-powered analog, the unit will consider fourteen operational variables in machining; that is, grade of carbide, speed, feed, depth of cut, tool life, alloy, material hardness, etc. It can be fed information about any of thirteen variables and come up with

Lehigh INC.

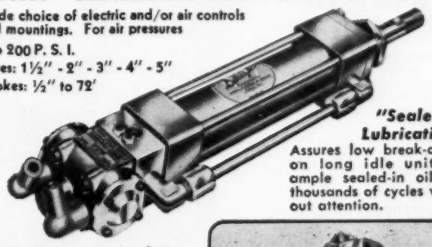
A COMPLETE LINE OF AIR CONTROL EQUIPMENT

Including precision-made HEAVY-DUTY

AIR MOTORS

WITH "SEALED-IN LUBRICATION" Pat. Pend.

Wide choice of electric and/or air controls and mountings. For air pressures 5 to 200 P. S. I.
Bores: 1½" - 2" - 3" - 4" - 5"
Strokes: ½" to 72'

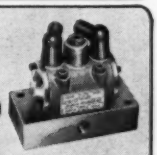


"Sealed-in Lubrication"
Assures low break-away on long idle units — ample sealed-in oil for thousands of cycles without attention.

"Sealed-in Lubrication"

AIR CYLINDERS
1½" to 8" bore

3 or 4-Way AIR POWERED VALVES



Air or electrically operated. J.I.C. Standards.

You Are Invited To Consult Our Engineering Department
freely on all air automation or replacement problems. Trained factory personnel available nationally.
Write for Catalogs and Name of Nearest Lehigh Representative

COMBINATION VALVES
Panel units, hand and foot operated valves. Wide range of models.

Lehigh Minor AIR VALVES and CYLINDERS

Low priced, light duty. For air operated jigs, fixtures, high speed operations.

Lehigh INC.
ENGINEERS & MANUFACTURERS
1513 Lehigh Drive
EASTON, PENNA.

Circle 20A on reply card

"DIX-LOCK"

Quick-Acting

AIR HOSE COUPLINGS

The "DIX-LOCK" is a convenient, modern coupling, light in weight but exceptionally strong and durable. Its quick-acting principle makes it especially efficient and economical for every kind of air and pneumatic service. Press two fittings together, give a quarter turn and the connection is made. To uncouple, pull back sleeve manually and coupling will unlock by a quarter turn. Completely streamlined—no projections of any kind—smooth exterior approximates outside diameter of hose. Interchangeable with couplings of the Bowes type. "Dix-Lock" Couplings are made in Hose Ends, and in various Male and Female I.P.T. End combinations. Brass and Cadmium Plated Steel. Sizes ⅜", ½" and ¾".

"BOSS"

Self-Honing

AIR VALVES

The most efficient and economical valves for all valve stations on the system—automatically, permanently leakproof—no packing to wear out and replace—straight-line, full-flow opening through body and plug.

Self-adjusting bronze plug automatically hones itself against harder steel or malleable iron valve body, maintaining a perfect leakproof seat. Proper spring tension assures constant sealing adjustment. Strong, durable construction, with handle attached to plug *within* the valve body. Male or female thread both ends, in sizes ¾" to 1½".

Stocked by Manufacturers and Distributors of Industrial Rubber Products

DIXON
Valve & Coupling Co.
GENERAL OFFICES & FACTORY—PHILADELPHIA 22, PA.
BRANCHES—CHICAGO · BIRMINGHAM · LOS ANGELES · HOUSTON
DIXON VALVE & COUPLING CO., LTD., TORONTO Associate Companies
Buck Iron Company, Inc., Quarryville, Pa. · Precision Drawn Steel Company, Camden, N.J.

Circle 21A on reply card

ADV. 23 (248)

the fourteenth, or answer. For example, of five variables that affect the motor horsepower required to do a specific job, it will provide the answer after being given data on four of the variables. The computer was developed by Dr. W.W. Gilbert (shown in accompanying picture working out a typical problem) in cooperation with Carboloy engineers and has been field tested for more than a year. It will be available in September.

Circle 14E on reply card

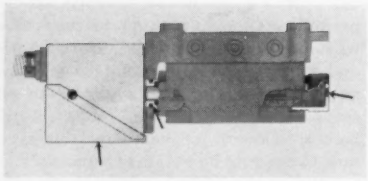
Heads of hammers, hatchets, axes, etc., cannot fly off, it is claimed, if the handles are affixed by a chemical compound called Permabond offered by Fayette R. Plumb, Inc.

Circle 15E on reply card

Aluminum-alloy air storage tanks are being tried out as replacements for steel units in the air-braking systems of gas turbine-driven locomotives in England. The object is to save weight while maintaining or increasing service life.

Special Hoover vacuum cleaners are being used in Great Britain's atomic-energy plants to sweep up dangerous particles of dust as microscopic as one ten-thousandth of an inch. The equipment has extra-smooth flexible hose lines and two filters that are renewed frequently. One is made of cloth and the other of resin-impregnated wool.

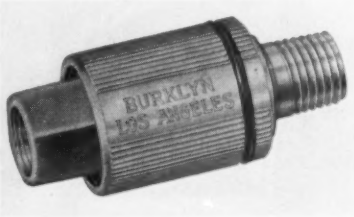
As a result of major changes in design and construction, all operating parts of C. B. Hunt & Son's O-Type solenoid valves are now protected against dust and grit which might otherwise work their way into the internal valve components or interfere with the proper action of the return spring. This has been accomplished in three ways: by providing the breather hole of the spring cap with



a sintered-bronze filter; by putting a sleeve, sealed with O-rings at two places, at the point where the solenoid armature comes in contact with the valve plunger; and by a 2-piece housing for the solenoid. The top half of the cover overlaps the bottom half with a tight fit and is easily removed by loosening two screws.

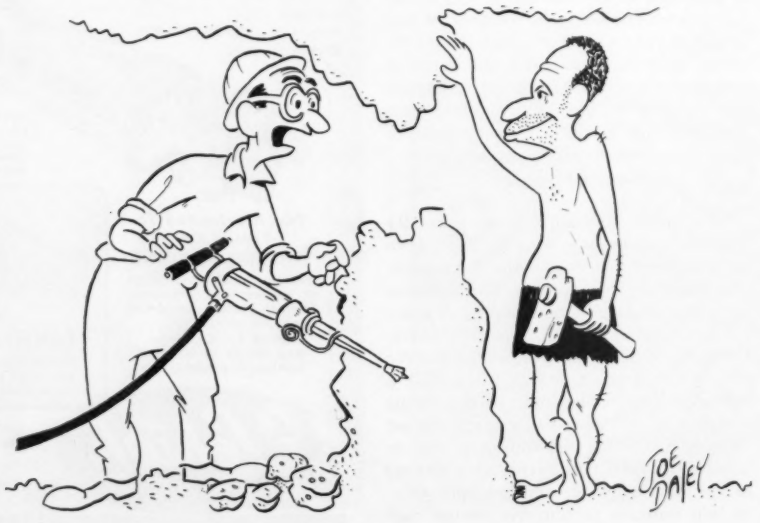
Circle 16E on reply card

After years of practical application in Southern California, Burklyn Company is offering its adjustable flow regulator for air, water, oil or gas to industry nationwide. Designed primarily for pneumatic tools and equipment, paint spray guns and the like, the device can also be used as a shut-off valve. It may be at-



tached directly to a supply line and is said to withstand a pressure of 1500 psi without leaking. Rotation of a knurled sleeve provides positive flow control; one revolution of the sleeve making possible eight adjustments each increasing or decreasing the orifice 0.004 inch. The regulator weighs only 4 ounces.

Circle 17E on reply card



QUOTES

—FROM HERE AND THERE

Vacuum Rids Tanks of Dents

"Straightening dents in wing-tip tanks of an airplane usually meant that the tank had to be cut to pieces, until the Glenn L. Martin Company developed a vacuum technique which pulls the dents out to the original, smooth aerodynamic contours. The equipment is portable.

"A plate, formed to the contour of the tank, is placed over the dent and sealed with a sponge rubber gasket. Vacuum is applied by a two-stage vacuum pump and the dents pop right out. Deformed stiffeners or stringers under the dented skin are also straightened by this method." *Plant Engineering, June 1955*

Why "Hidden Splendor?"

Floyd B. Odlum, president of Atlas Corporation, New York investment firm that has recently acquired several uranium mining properties on the Colorado Plateau, made the following remarks in a recent address:

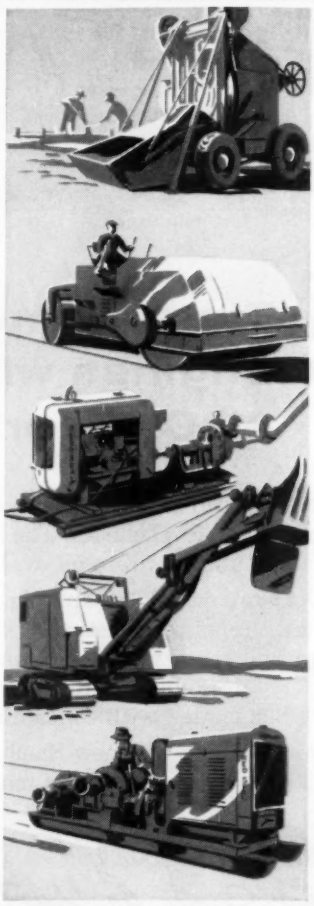
"I am often asked why I bought Vernon Pick's uranium mine on behalf of Atlas Corporation and named it Hidden Splendor. And sometimes I have replied by saying it was because I heard and followed the directions of strange voices. These voices came from within rocks, and little invisible characters talked to me about weird things. There were a lot of these characters, who said they were organized together into what they called 'uranium atoms.' Each atom had a central group commander called 'nucleus.'

"Nucleus claimed that he and his associates had been waiting for billions of years to go to work as slaves for man but had only received the call recently. Nucleus said he and his fellow nuclei had to go through a form of suicide to perform their work, which was accomplished by changing a part of their own mass or bodies into energy. Nucleus said that the work task was started by having himself shot by one of his associates called neutron.

"These characters boasted extravagantly what they could do if I would buy Vernon Pick's mine. They said that within three or four months they would make it worth more than double my cost but that they would by no means stop there. The invisible fellows have made good their promise and the forecast Mr. Pick made to me when I bought the mine. . . .

"I expect to live to see not only central station atomic power plants on land but also atomic powered planes in the air and atomic powered freight and passenger ships at sea, even though I may not live

Ingersoll-Rand GR-125 Compressor, supplying air for PB8 paving breakers. Power — Continental Red Seal F-162.



Speed the Job ...Cut the Cost with DEPENDABLE RED SEAL POWER

Continental Red Seal power is saving money for owners of specialized equipment in all phases of the construction industry. You find Red Seals of varying sizes and specifications (14 to 237 horsepower—for operation on all standard fuels) in more and more leading makes of compressors, mixers, rollers, pumps, shovels, winches, and other machines at the job site. And you find them delivering their full work quota, with a minimum of down time, because each is engineered expressly for its job—built to do one thing and do it well.

SERVICE FACILITIES AND GENUINE RED SEAL PARTS AVAILABLE EVERYWHERE

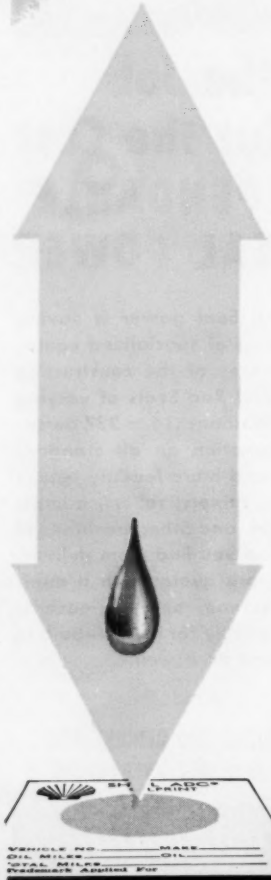
Continental Motors Corporation

MUSKEGON • MICHIGAN

6 EAST 45TH ST., NEW YORK 17, NEW YORK • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF.
6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 910 S. BOSTON ST., ROOM 1008, TULSA, OKLA.
1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GA.

Circle 22A on reply card

A New PM TOOL for Diesels



SAVE Time, Money, Oil and Engines with the Shell ADC* Oilprint Analysis

Now—operators can test crankcase oil in the short time allotted for re-fueling and oil level checks. The Shell ADC Oilprint Analysis gives a practical and accurate oil evaluation in minutes.

ADC Oilprint Analysis means big savings when used in your preventive maintenance program . . . gives valuable information on engine and oil conditions. It answers the question "When do I change my oil?" thus eliminating the draining of usable oil and the risk of using oils loaded with contaminants.

See for yourself how the new Shell ADC Oilprint Analysis can save you real money in preventive maintenance. *Trademark

Let us demonstrate how you can use this Service for Your Diesels

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

Circle 23A on reply card

to see, as an economical means of transport, an atomic powered automobile or an economical atomic dry battery. . . .

"Is it any wonder that Atlas Corporation acquired . . . a uranium mine so full of potentials, located as it is in the heart of the Colorado Plateau? And, having some primary knowledge of what is going on in the hearts of the atoms buried away in the rock in that mine, is it any wonder that I named that mine Hidden Splendor?"

Air Agitation Produces Fine Marshmallow

"At the Curtiss Candy Co., Chicago, marshmallow products are produced in a continuous flow process—using compressed air and diffusion chambers, which involve no moving parts and no mechanical beaters . . . .

"Ingredients are mixed to form a syrup, and pumped into machine. Compressed air at 200 psi is introduced, and the turbulent mixture injected through an orifice against a target in the first of two mixing chambers.

"As stream hits target it is mixed and atomized. This aerated mixture is then injected into another similar chamber for further mixing, then discharged into a diffusion chamber, where it is transformed into a multitude of fine globules. This diffusion, or whipping, chamber is packed with special ceramic 'marbles' $\frac{3}{8}''$ in diam. Finely whipped marshmallow emerges into a hopper, where color may be added if desired . . . .

"The air-liquid diffusion operation is self-cooling and conducted at relatively low temperatures. Hence, there is no danger of the product breakdown due to swelling and bursting of the air bubbles through overheating.

"Density of the product can be controlled easily by varying the relative proportions of air and liquid at the valves . . . . The machine can also be used for whipping frappes, nougat cream, mazetta, or fudge. Clean-up of the apparatus is easy."

Food Processing, May 1954

"I wish I could pay you what you're really worth Peters, but there's the minimum wage law you know."

...Here's why you get higher efficiency from Ingersoll-Rand MOTORPUMPS

In the final analysis, the efficiency of a pump is determined by the volume and pressure of the liquid delivered compared to the electric power consumed. And here are 4 "reasons why" Ingersoll-Rand Motorpumps give you this greater efficiency:

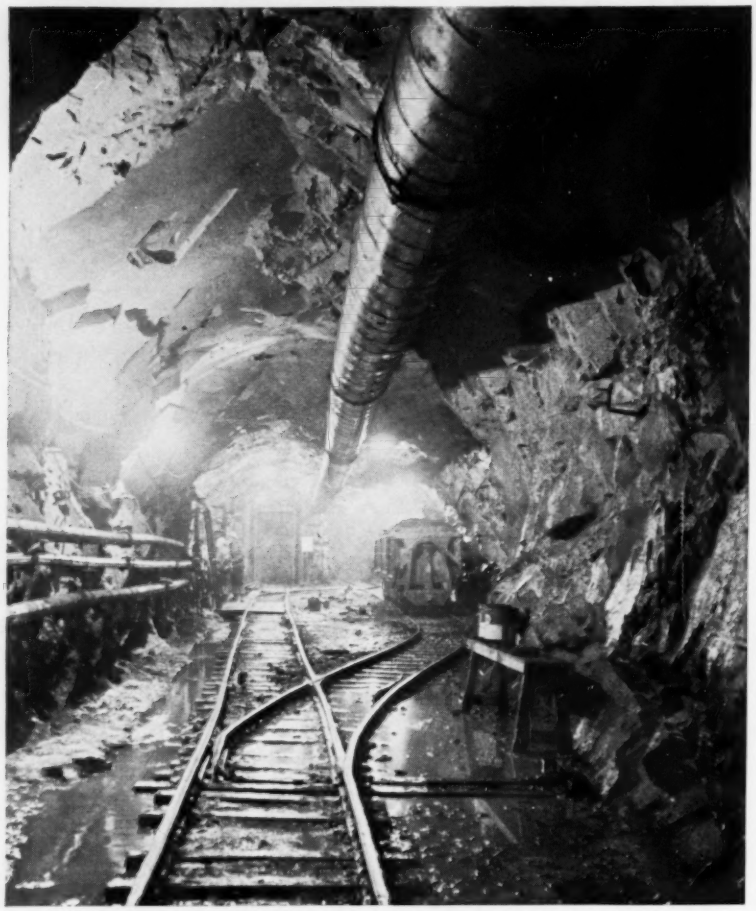
1. Better design of pump impellers, casing volutes and inlet and discharge passages assure maximum capacity.
2. Better foundry and coring techniques assure clean, smooth pump casings and impellers providing smooth, unimpeded liquid flow.
3. Precision machining assures accurate balance and exact clearance between impeller and casing for best performance under all loading conditions.
4. Thorough inspection assures dimensional accuracy and rigid adherence to design standards.

For *all* the "reasons why" you get higher efficiency from Ingersoll-Rand Motorpumps in sizes from ¼ to 75 hp, write for our New Motorpump Catalog, Form 7093-E.

Ingersoll-Rand
11 Broadway, New York 4, N. Y.

9-209
Circle 24A on reply card

DEEP BREATHING



You can't dig a tunnel without adequate air supply and there's no better vehicle for push-pull ventilation than lightweight Naylor Spiralweld pipe. That's why you see so much of this distinctive pipe in underground construction. It's easy to handle, install and extend as work progresses, particularly when you use the one-piece Naylor Wedge-Lock coupling to speed connections. The exclusive lockseam spiralweld structure adds collapse strength, permitting the use of lighter gauge material for economy.

For your "deep breathing" jobs, it will pay you to check these Naylor advantages. Write for Bulletin No. 507.

NAYLOR PIPE

NAYLOR PIPE COMPANY

1245 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Circle 25A on reply card

Books and Industrial Literature

The third edition of *Heat Power* is now available under the title of *Applied Thermodynamics* because the primary purpose of the 490-page book is to develop an understanding of the fundamentals of thermodynamics as applied to power generation from heat sources. As most young men are familiar with the design and operation of the internal-combustion engine, the text starts with that subject and deals successively with each of the other types of heat engines, finally discussing proposed atomic-power converters. One chapter deals with compressors of the displacement and kinetic types and another is devoted to refrigeration. Representative problems are given in each of the fields under consideration, and illustrations and cut-away drawings of modern power equipment are shown. Originally written by Earle B. Norris, now dean emeritus, School of Engineering, Virginia Polytechnic Institute, and by the late Eric Therkelsen, professor of mechanical engineering, Montana State College, the current edition was revised and brought up to date by Clarence E. Trent, professor of mechanical engineering of the Institute, under the supervision of Dean Norris. Published by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N.Y. Price, $7.50.

Bulletin 1066-5 obtainable from Rockwell Manufacturing Company is devoted to its complete line of gas-testing equipment.

Circle 18E on reply card

The features of seven basic types of fusible service entrance devices for home, farm, commercial and light industrial applications are explained in a 16-page booklet—GEA-6286—offered by General Electric's Trumbull Components Department.

Circle 19E on reply card

Bulletin No. 52 recently prepared by John Waldron Corporation deals with its couplings of special design and materials for high-speed applications. The units are tested by a new method of dynamic balancing, which is described in detail.

Circle 20E on reply card

A P Controls Corporation is distributing a bulletin, Form RS141, dealing with its full line of solenoid valves for liquids, gases and refrigerants. In addition to listing their capacities and typical applications, the publication gives information enabling a user to select the valve he needs for a specific purpose.

Circle 21E on reply card

A fully integrated, automatic shell-molding system, including a 4-station machine for forming and curing mold halves, a closing machine for completing the molding operation, and all process equipment for sand preparation to handling of finished castings, is described in Booklet No. 2462 published by the manufacturer, Link-Belt Company. Cutaway drawings and photographs explain each step of the process, which is said to produce up to 240 quality molds an hour.

Circle 22E on reply card

Freeland Gauge Company has announced that is is now producing gauge blocks and accessory sets for extremely accurate measurement control in metalworking. One of the first sets in the line is the F-81 consisting of 81 special alloy-steel blocks that are said to provide approximately 240,000 different

gauges in 0.0001 steps from a minimum of 0.2 inch to a maximum beyond 12 inches. This, together with other sets, is described and illustrated in a 4-page folder, which also gives information about the firm's inspection and reconditioning service.

Circle 23E on reply card

In a new 4-page folder, American Agile Corporation illustrates and describes its complete line of plastic products, semifinished components and production equipment. Also outlined are the engineering, fabrication, installation and other services the company is prepared to render.

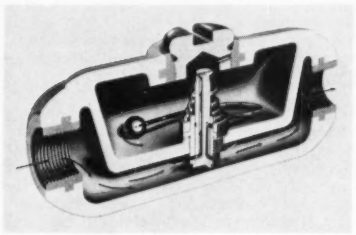
Circle 24E on reply card

National Screw Machine Products Association, 2860 East 130th Street, Cleveland 20, Ohio, has published a Buyer's Guide that has been prepared primarily with consumers, purchasing agents and designers of screw-machine products in mind. They can obtain it free of cost upon request written on company letterheads.

Vari-Pitch speed changers are described and illustrated in a new bulletin announced by Allis-Chalmers Manufacturing Company. They are available in twelve sizes from 1 to 75 hp with output speeds up to 2900 rpm and can be made suitable for reversing service by the addition of a simple tension stabilizer.

Circle 25E on reply card

Users of pneumatic tools should be interested in a bulletin prepared by Ingersoll-Rand Company on air-line lubricators and lubrication as such, a subject of vital importance because it is conservatively estimated that more than 50 percent of air-tool failure is attributable to improper lubrication. The new units described in the circular

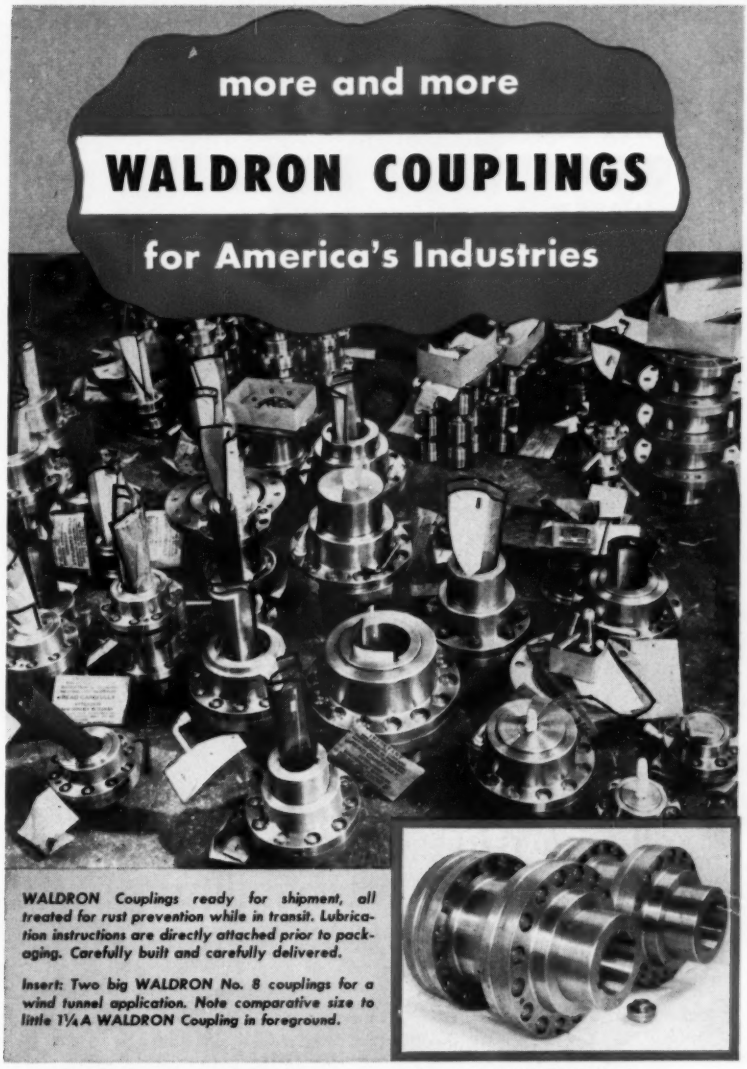


are of ½- and 1-pint size for the smaller types of hand-held tools. They are designed on simple lines with no moving mechanical parts to insure adequate lubrication at all times. They are provided with a metering valve to adjust the oil feed, can be filled without shutting down tools and are said to handle any oil or liquid grease that will flow at the temperature in which the tools are to work. The bulletin, Form 4169, also discusses the company's 1-, 2- and 12-quart air-line lubricators for larger equipment, including the biggest quarry-type drills.

Circle 26E on reply card

Industrial Actuators & Controls Division of National Pneumatic Company, Inc., 125 Amory Street, Boston 19, Mass., offers two bulletins giving full information about its power-drive cylinder (Circular IC-2.3) which operates on 500 psi oil or 200 psi air, maximum, and its line of pneumatic-hydraulic actuators and controls (IC-2.2) for production machinery. Either or both are available.

Information on the latest developments in coloring anodized aluminum has been compiled by Sandoz Chemical Works, Inc., 61 Van Dam Street, New York 13, N.Y., and is



WALDRON Couplings ready for shipment, all treated for rust prevention while in transit. Lubrication instructions are directly attached prior to packaging. Carefully built and carefully delivered.

Insert: Two big WALDRON No. 8 couplings for a wind tunnel application. Note comparative size to little 1¼A WALDRON Coupling in foreground.

The steadily increasing popularity of WALDRON Gear Type Couplings stems from their many design refinements, sturdy construction and operating advantages which combine to insure their longer service life. Year after year, more and more users find a WALDRON Coupling the most economical to buy. They are first choice today of leading equipment builders. Write for literature describing various types.

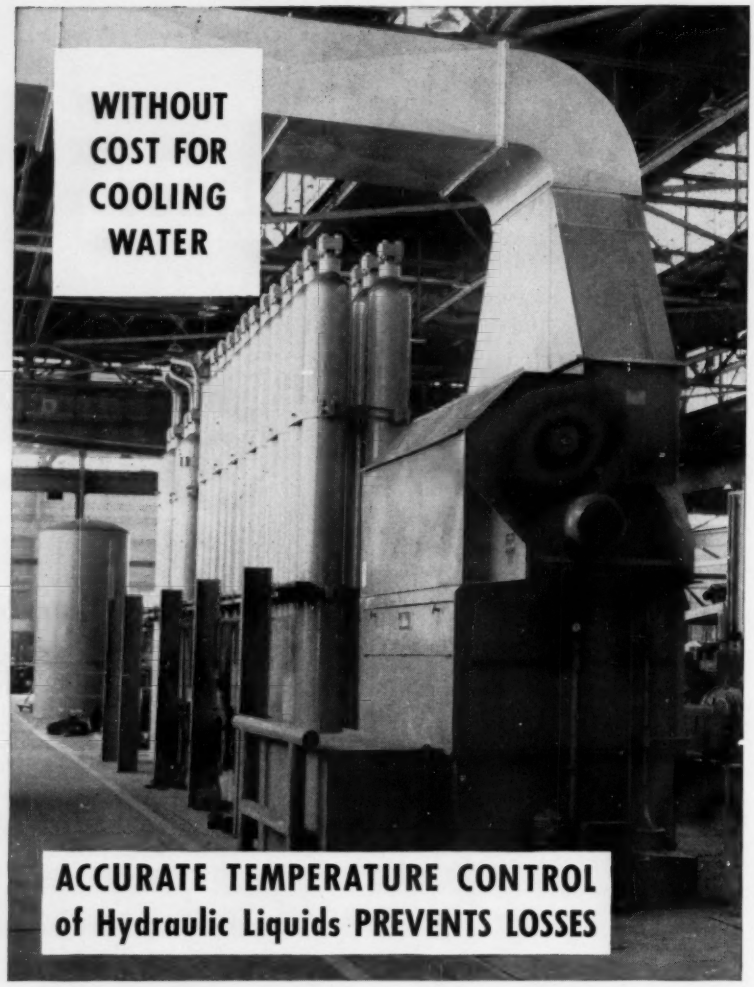
STANDARD • HEAVY DUTY MILL • SHEAR PIN • CUT-OUT
FLOATING SHAFT • SPACER • OIL COLLECTOR • SPECIAL TYPES

WALDRON couplings are available in sizes up to 18" shaft diameter. We specialize in furnishing couplings for unusual applications and services. We would be pleased to send you our latest bulletin 55 upon request.

JOHN WALDRON CORPORATION
New Brunswick, N. J.
Since 1827

Sales Representatives In Principal Cities

Circle 26A on reply card



● This NIAGARA AERO HEAT EXCHANGER cools the liquid for a large hydraulic press, preventing heat damage to the pump stuffing boxes. Using outdoor air as the evaporative cooling medium, it removes the heat at the rate of input (1,875,000 BTU/hr.) with no cooling water consumption except a negligible amount evaporated.

Air is free and cheaper to move than water. You can save much expense in pumping, piping and power, and quickly recover the equipment cost from the water saving.

Similar Niagara machines cool water, oils, solutions, lubricants and coolants for many mechanical, electrical and chemical processes. You can cool quench baths, welding machines, plastic molds, furnaces, controlled atmospheres, gases, compressed air either for power or instruments or processes. In a closed system, your coolant is never contaminated. The system is simple and easy to keep up; the equipment has a long, useful life. Select from a wide range of sizes up to 30,000,000 BTU.

Write for Bulletin 120 to obtain a complete description.

NIAGARA BLOWER COMPANY

Dept. CA, 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of United States and Canada

Circle 27A on reply card

available to the metal-finishing and related industries. Requests must be written on company letterheads. The booklet takes up a wide variety of related subjects, including: aluminum finishes and anodizing methods, properties and peculiarities of dyestuffs, surface preparation, dyeing procedure and control methods. Samples of the most popular colors are shown.

The properties and industrial, commercial and home uses of seven new and improved plastics are listed in a 6-page bulletin published by Homalite Corporation. The most outstanding of the group, Dura-lite, can be machined, formed and fabricated and is said to be highly resistant to chemical attack, crazing and abrasion.

Circle 27E on reply card

Manufacture of the first bronze globe valve with Brinalloy seats and disks has been announced by Lunkenheimer Company in a circular released recently. The alloy, developed by the company, is said to be so resistant to wear and corrosion that the LQ600, as the new valve is designated, has required no maintenance or repair after four years of field tests.

Circle 28E on reply card

Prab Conveyors, Inc., has available Catalogue 400 descriptive of its conveying equipment including, among others, the Magnavator, a magnetic elevator for handling small parts; the Tube-Veyor, a totally enclosed unit for bulk materials; custom-built bucket elevators; screw, belt, vibrating and pneumatic conveyors; and flux and chip-handling systems.

Circle 29E on reply card

Johns-Manville has published a 28-page manual on its Clipper Oil Seals. It enters into their selection, application and installation and includes graphic photographs and drawings, data in tabular form, and case histories of their service in the petroleum, automotive, mining, earth-moving, aviation, iron and steel, machine tool and process industries.

Circle 30E on reply card

Moisture, the Industrial Fifth Column is the title of a 10-page bulletin that deals comprehensively with the dehumidification of compressed air and gases. Published by Desomatic Products, Inc., it discusses water- and refrigeration-cooled dehumidifiers and adsorption systems, together with their applications. A chapter on "Moisture Load in Compressed Air Lines" is also included.

Circle 31E on reply card

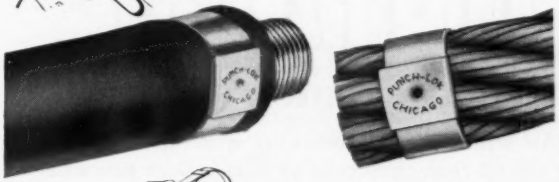
Fascinating!

SHIMMY and SHAKE

once you choose it—
you won't loose it!

PUNCH-LOK HOSE CLAMPS

"Got vibration problems?" asks Doc Punch. "Call in a specialist — your nearby Punch-Lok distributor. He'll solve your problem in a hurry!"



"The sign of a GOOD Hose Clamp"

Fastening hose or seizing tough wire rope—Punch-Lok clamps do the jobs with equal facility!

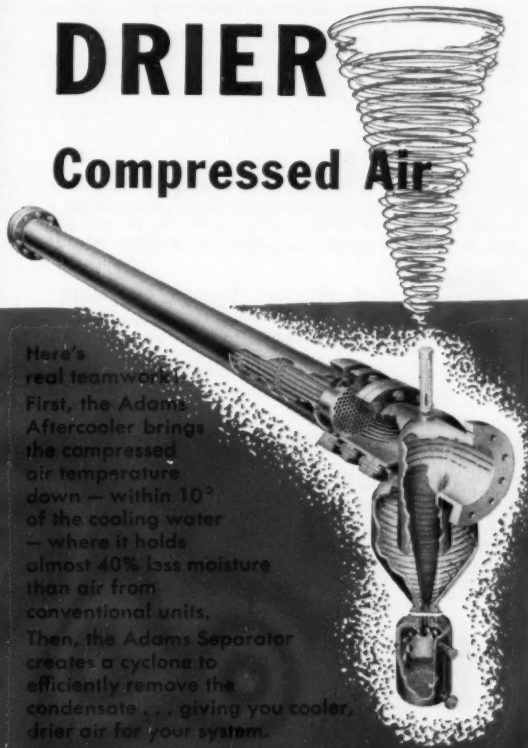
Write for complete product and price information.

PUNCH-LOK Company

5696

Dept. H, 321 North Justine Street • Chicago 7, Illinois

We create a CYCLONE to give you DRIER Compressed Air



Here's real teamwork. First, the Adams Aftercooler brings the compressed air temperature down — within 10° of the cooling water — where it holds almost 40% less moisture than air from conventional units. Then, the Adams Separator creates a cyclone to efficiently remove the condensate . . . giving you cooler, drier air for your system. Thousands in use throughout industry. It will pay you to find out all the details. Mail the coupon below today.

R. P. ADAMS CO., Inc.

Buffalo 17, New York

R. P. ADAMS CO., INC. AU-55
209 East Park Drive
Buffalo 17, N. Y.

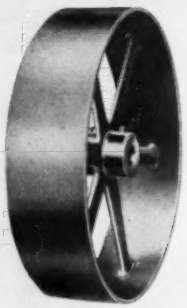
Please send my FREE copy of Bulletin #711 on Adams Cyclone Separators and Aftercoolers.

Name ..... Firm .....

Street ..... City ..... State .....

stock or standard pulleys

STOCK "SURE-GRIP" PULLEYS



STANDARD PULLEYS

STOCK "SURE-GRIP" PULLEYS

Cast iron with straight or crown face. One-piece flanged and split tapered hub permits easy installation and removal from shaft, four hubs take care of bore range from ½" to 4¼". "Sure-Grip" Pulleys are available in sizes from 4" to 36" O. D., in face widths from 2½" to 12". From Stock. SEND FOR BULLETIN #297 REV.

STANDARD PULLEYS

Cast Iron. Available in all types; standard flat belt pulleys, solid or split, single or multiple arm, and flanged, if required. Bronze bushed or ball bearing equipped loose pulleys, conveyor, taper cone and special designs made to customer's specifications. WRITE FOR DETAILED INFORMATION.

T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PA.

Cambridge, Mass. Newark, N. J. Dallas, Texas Cleveland, O.

Circle 30A on reply card

NO AIR LEAKS UNDER PRESSURE

(or vacuum)

with

HILLS-McCANNA

"cushion closure" action

Here's the valve with the cushioned, leak tight closure that actually *accommodates* itself to surface irregularities, scale or foreign material. Suitable for pressures to 150 psi, temperatures to 170° F. Lever, handwheel or power operated, all working parts isolated from flow. Design eliminates packing. Write for bulletin. HILLS-McCANNA CO. 2361 W. Nelson, Chicago 18, Ill.

HILLS-McCANNA

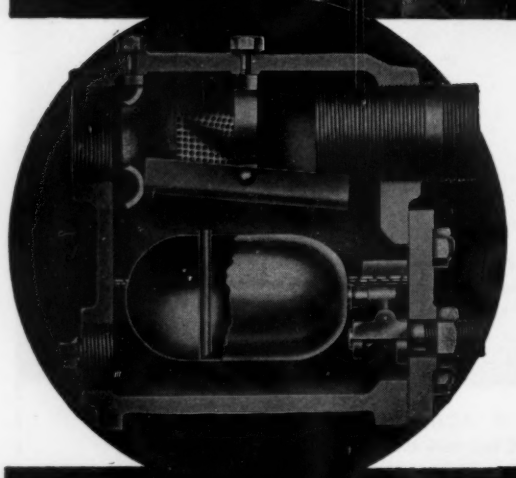
saunders patent diaphragm valves

Also manufacturers of
Chemical Proportioning Pumps • Force-Feed Lubricators
Light Alloy Castings

Circle 31A on reply card

DRI AIR MAY BE INSTALLED BY SUSPENDING IT FROM THE PIPING WITHOUT ANY OTHER SUPPORT.

INCREASED PNEUMATIC EFFICIENCY WITH THIS AUTOMATIC SEPARATOR



A TYPICAL INSTALLATION SHOWING DRI AIR STANDING ON A CONCRETE FLOOR NEXT TO THE WALL.

PROTECT EQUIPMENT WITH

DRIAIR

SEPARATES • COLLECTS • DELIVERS

• DriAir separates and automatically ejects the condensed water and oil from compressed air lines, collects pipe scale and rust, delivers clean dry air to tools and other pneumatic equipment. This promotes better lubrication, reduces wear, increases life of tools and produces greater output. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent.

WRITE FOR BULLETIN DA WHICH FULLY DESCRIBES THE CONSTRUCTION AND OPERATION OF THE DRIAIR.

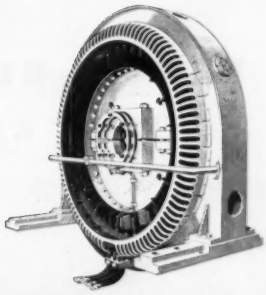
NEW JERSEY METER CO.

"SPECIALISTS IN COMPRESSED AIR DEVICES"

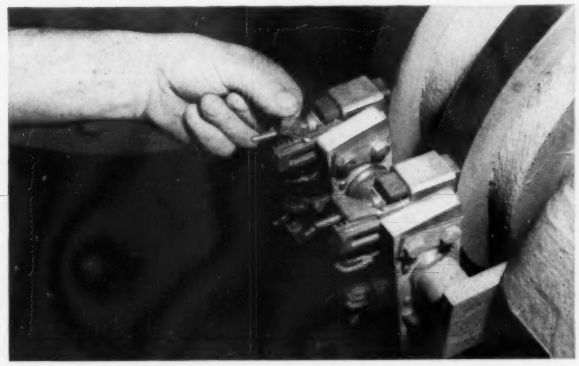
PLAINFIELD, NEW JERSEY

Circle 32A on reply card

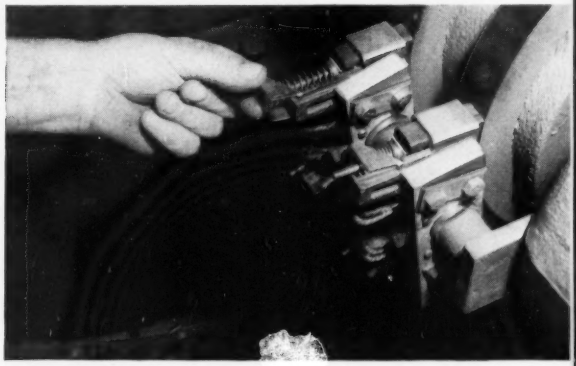
Circle 33A on reply card



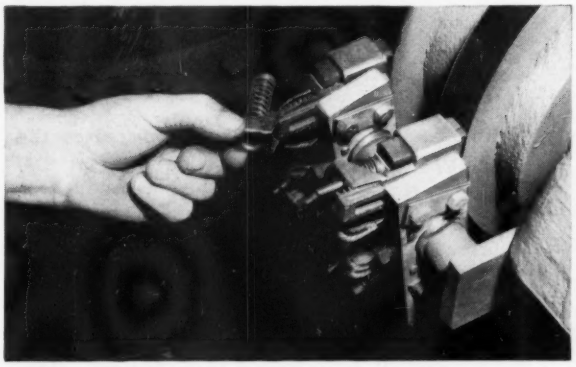
HOW G-E SYNCHRONOUS MOTORS REDUCE MAINTENANCE COSTS



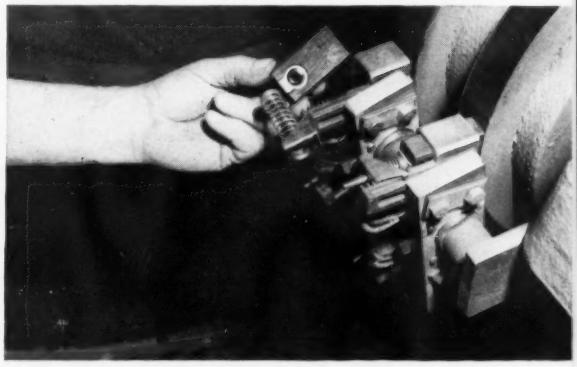
10 seconds. To start changeover, unscrew lead, release lock.



15 seconds. Slide lock back.



25 seconds. Swing locking device to one side. Remove old brush.



Install new. Changeover made in less than 60 seconds.

One-minute Brush Changeover!

As experienced motor maintenance men know, replacing worn brushes can be time consuming and costly. Not so on General Electric low-speed synchronous motors!

G.E.'s calibrated spring-loaded brush holder makes brush removal so easy it can even be done with one hand if necessary. You just unscrew the lead, release the spring lock, remove the worn brush and slide in the new. The whole operation takes less than 60 seconds per brush!

In addition, the brush holder's calibrated pin gives a clear indication of brush wear. Simply by slipping the lock down the holder you can maintain proper pressure and obtain optimum brush performance.

If you want a motor that is easy to inspect, call your nearest G-E Apparatus Sales Office. A sales engineer will gladly explain the many other advantages of G-E low-speed synchronous motors. General Electric Co., Schenectady 5, N. Y. 770-37

Progress Is Our Most Important Product

GENERAL ELECTRIC

HERE'S BIG-CAPACITY DIGGING ABILITY YOU CAN MOVE FROM JOB TO JOB

The 180-W swings a 5-yd. medium-duty bucket on a 120-ft boom. Other boom and bucket combinations are available.

ON levee work, dam construction, contract stripping — any big job — you are ahead with the economical, high-capacity dirt-moving offered by a Bucyrus-Erie walking dragline. In the 180-W you have it — along with unmatched ease in moving from job to job.

The 180-W is readily dismantled for shipping. No main machinery components are disturbed. You never need worry about misalignment problems. The complete machine is easily loaded on five U. S. railroad cars, and is easily reassembled. This ease of moving saves you time and expense and greatly increases the 180-W's value throughout its life.

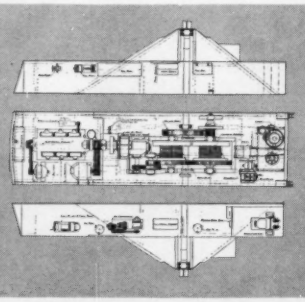
Besides its unusual portability, the 180-W brings to more jobs the dependable, big-output performance, quick maneuverability, long working range, and low maintenance costs common to all Bucyrus-Erie walking draglines. Send for complete information. 50L55

BUCYRUS ERIE

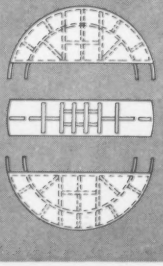
SOUTH MILWAUKEE, WISCONSIN

5 U. S. RAILROAD CARS CARRY ENTIRE MACHINE

Side wings unbolt from center section of revolving frame. Main machinery remains fully assembled and in proper alignment.



Base is in three separate welded-steel sections, joined by bolting flanges — easily disassembled and shipped.



Circle 34A on reply card

BUILT TO BE ABUSED...

It's U. S. Matchless® Wire Braid Air Hose!

This is the hose engineered specifically for hard rock mining, quarrying and tough construction work anywhere in the world—designed by men who *know* what a hose must do.

U. S. Matchless Wire Braid Hose is an all-purpose hose. It can take the highest required working pressures for both air and water, and is built to take the abuse and abrasion encountered in the roughest working conditions. Highly flexible and easy to handle. Never needs cribbing.

Constructed with a Neoprene tube overlaid with high tensile steel wire braid. Top quality brown natural rubber cover. Has extremely high adhesion to carcass.

No matter what your hose requirements are, United States Rubber Company can fill them. Here's where quality pays off—and demonstrates that money is wasted when spent on cheaply-constructed, short-lived hose. Expert "U. S." engineers will aid you in your hose selection and engineering problems. Call any of the 27 "U. S." District Sales Offices.

"U.S." Research perfects it . . . "U.S." Production builds it . . . U.S. Industry depends on it.

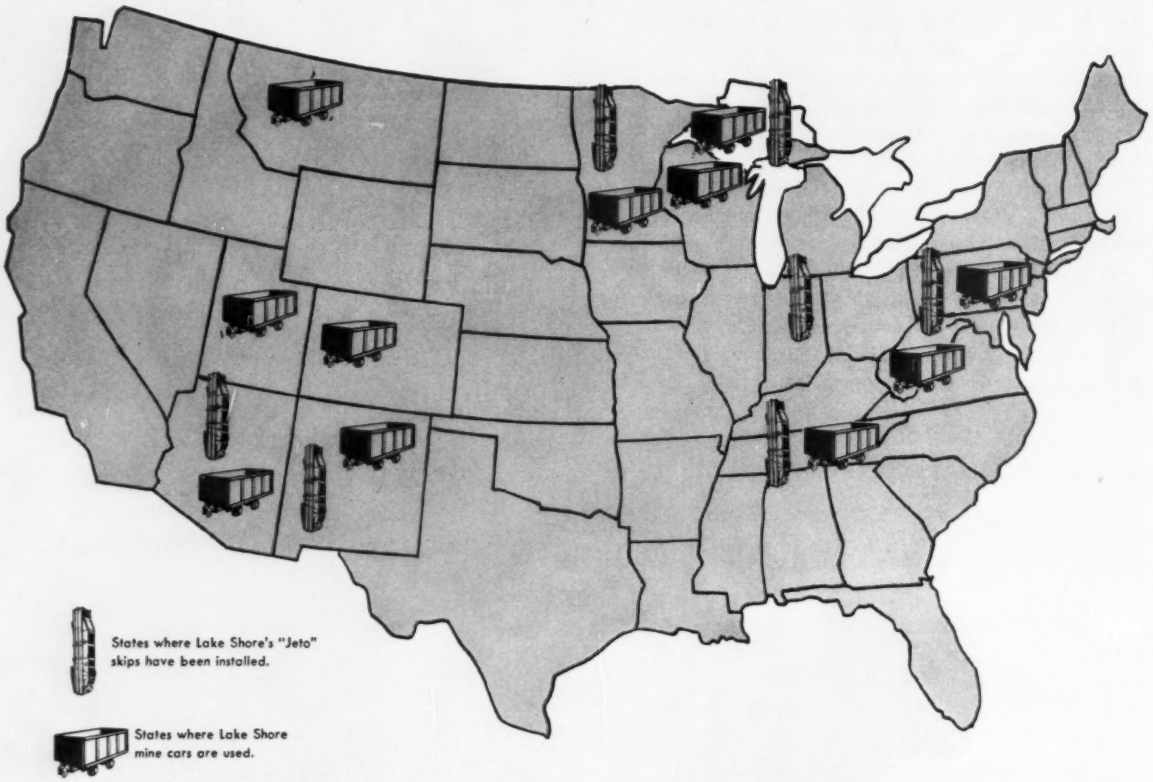
UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

Circle 35A on reply card

Lake Shore mining equipment in operation across the nation—



Lake Shore's "Jeto" bottom-dump skips and "Lohed" mine cars are in operation in mines across our nation, in Canada, and other parts of the world. Mine operators from Pennsylvania to Arizona, from West Virginia to Montana, and in distant places such as Peru, and Zonguldak, Turkey, have found that this Lake Shore equipment improves their production, efficiency, and safety record.

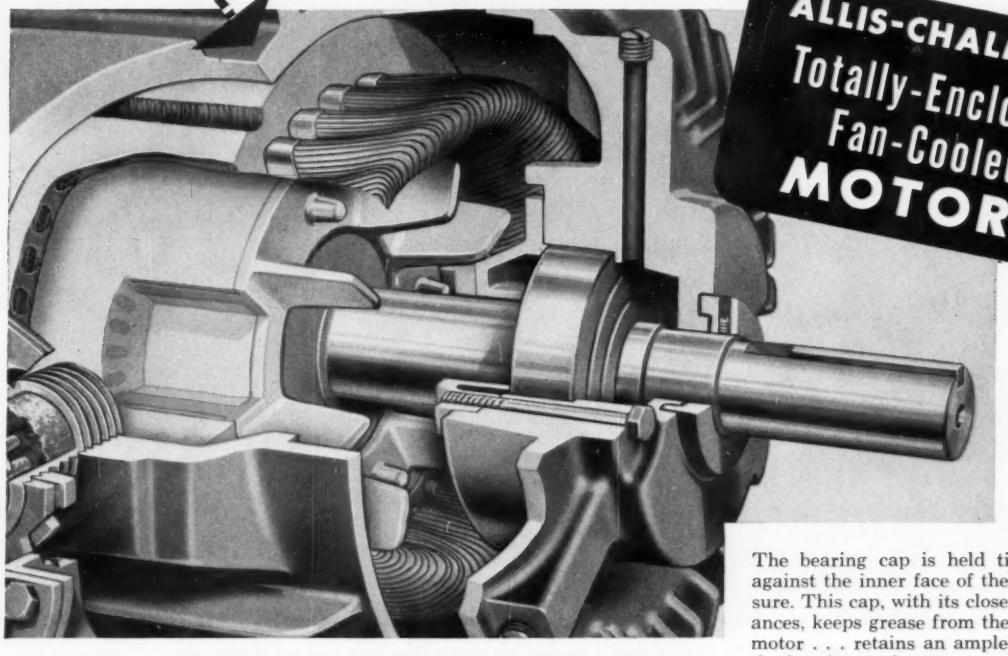
The "Jeto's" lightweight aluminum and steel construction, and its cleaner, faster bottom-dump action, increases payloads . . . boosts production. Rounded corners and simple rugged construction make the all welded "Lohed" mine car a durable, long-lasting piece of equipment . . . easy to maintain. Write for product bulletins giving full details and specifications.

LAKE SHORE
Engineering Company

IRON MOUNTAIN 5, MICHIGAN

Plants: Iron Mountain and Marquette, Michigan

Get Both
bearing features



ALLIS-CHALMERS
Totally-Enclosed
Fan-Cooled
MOTORS

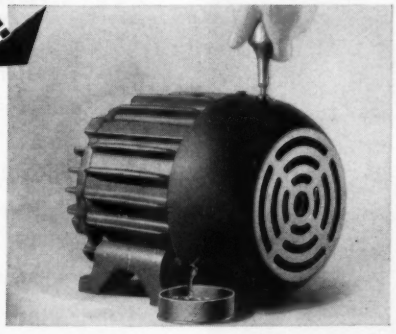
fully enclosed and protected

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

. . . yet easy to grease

You can lubricate the bearings without dismantling the motor. Pipe-tapped holes in the bearing housings at three points provide both means for inserting new grease and a means of flushing out old grease.



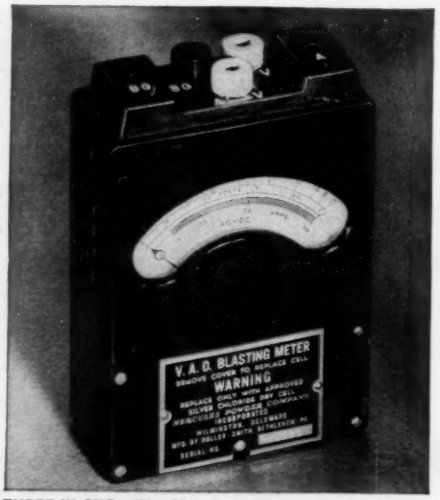
Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7225.

A-4609

ALLIS-CHALMERS

HIGH CAPACITY, YET PORTABLE—The Titan Blaster is housed in a rugged aluminum case and is waterproof.

NEW HERCULES TITAN BLASTER



THREE-IN-ONE—The V.A.O. meter, available through Hercules, is a combination voltmeter, ammeter, and blasting galvanometer that has proved its value in field use as an important blasting aid.

For Maximum Safety, Economy

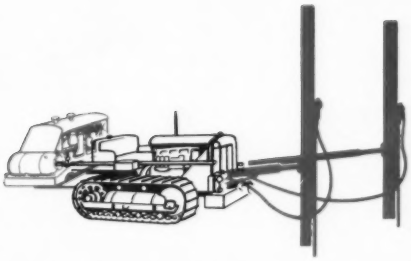
The Hercules Titan® Blaster is a high-capacity, condenser discharge type of blaster that combines maximum safety with minimum maintenance expense.

The Titan Blaster has no moving parts. It is operated by depressing two push-button switches—one to charge and one to fire. This new Hercules blaster develops sufficient electrical energy to fire as many as 1,200 detonators. Yet, there is no high voltage associated with the Titan Blaster except during charge and firing. The source of energy is a relatively inexpensive 6 volt, dry cell ignition-type battery.

For full technical details on the Titan Blaster, write:

HERCULES POWDER COMPANY
INCORPORATED
Explosives Department, 932 King St., Wilmington 99, Del.

XR55-7



Hydra-Boom

DRILLING RIG

- *increases production*
- *cuts drilling costs*
- *converts setup time to drilling time*

TAKE a truck or tractor. Add a pair of rugged Ingersoll-Rand Hydra-Boom drill mountings with famous X71-WD Drifters and feeds, a Gyro-Flo compressor—Result!—a self-powered, self-propelled drilling rig that will save man hours and cut by far the number of Jackhamers, wagon drills needed on a rock excavation job.

Hydra-Booms lift, swing, extend and retract under smooth, hydraulic power. Drill towers are spotted where you want them at the throw of a valve. Operators spend their time *drilling rock*—not tugging heavy equipment around on rough terrain.

Actual experience on jobs has shown that Ingersoll-Rand Hydra-Boom Drilling Rigs can cut, by 50% or more, the total cost per foot of hole and double production per shift.

Hydra-Booms are big and rugged—They have larger, more powerful hydraulic cylinders to work at lower pressures—piston packings last longer in heavy-duty service. Short, direct piping from the compressor to the drills eliminates friction losses, pipe line and air hose maintenance and air-line breaks due to freezing, blasting or collisions. There is always maximum air pressure at the drills. Also the service-proved efficiency and dependability of the Ingersoll-Rand Gyro-Flo rotary compressor mean long-range savings in air power costs.

For the complete Hydra-Boom story, see your nearest I-R representative or write to Ingersoll-Rand for Bulletin No. 4169.

CARSET JACKBIT

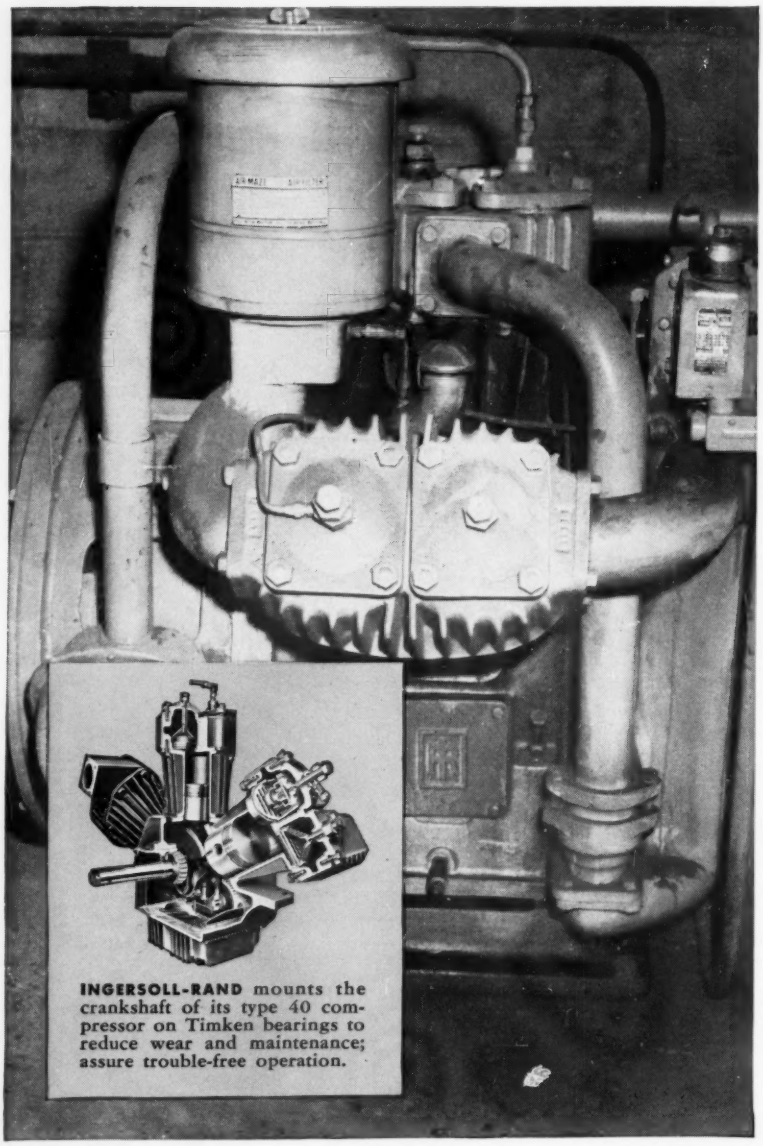
Ingersoll-Rand

5-180 **11 Broadway, New York 4, N. Y.**

ROCK DRILLS • COMPRESSORS • AIR TOOLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL & GAS ENGINES

38A on reply card *Circle 39A on reply card*

New York cleans up with help of Ingersoll-Rand compressor and TIMKEN® bearings



INGERSOLL-RAND mounts the crankshaft of its type 40 compressor on Timken bearings to reduce wear and maintenance; assure trouble-free operation.

THIS Ingersoll-Rand type 40 compressor powers the air-type grease guns that help keep New York's garbage wagons on the go. And with Timken® tapered roller bearings on the compressor's crankshaft, New York cleans up even more. Wear is reduced, maintenance costs are cut and long life assured.

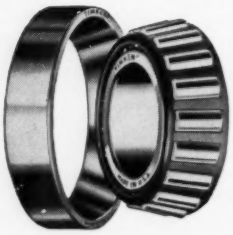
Timken bearings reduce wear because their true rolling motion and incredibly smooth surface finish practically eliminate friction. And because the tapered construction of Timken bearings enables them to take any combination of radial and thrust loads, the crankshaft is held in positive alignment.

Timken bearings keep housings and shafts concentric—making closures more effective in keeping dirt out, lubricant in. As a result, maintenance costs are held to a minimum.

Timken bearings handle the crankshaft loads with ease. Full line contact between rollers and races gives Timken bearings extra load-carrying capacity.

To get all these advantages in the equipment you build or buy, always specify Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

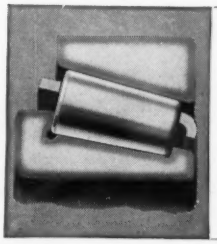
This symbol on a product means its bearings are the best.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



GREATER LOAD AREA

Because the load is carried on the *line* of contact between rollers and races. Timken bearings carry greater loads, hold shafts in line, wear longer.

Only Timken tapered roller bearings have these advantages: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. nickel-rich Timken alloy steels.

"NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⓪ AND THRUST →⓪← LOADS OR ANY COMBINATION →⓪←

Circle 40A on reply card